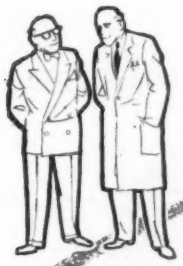
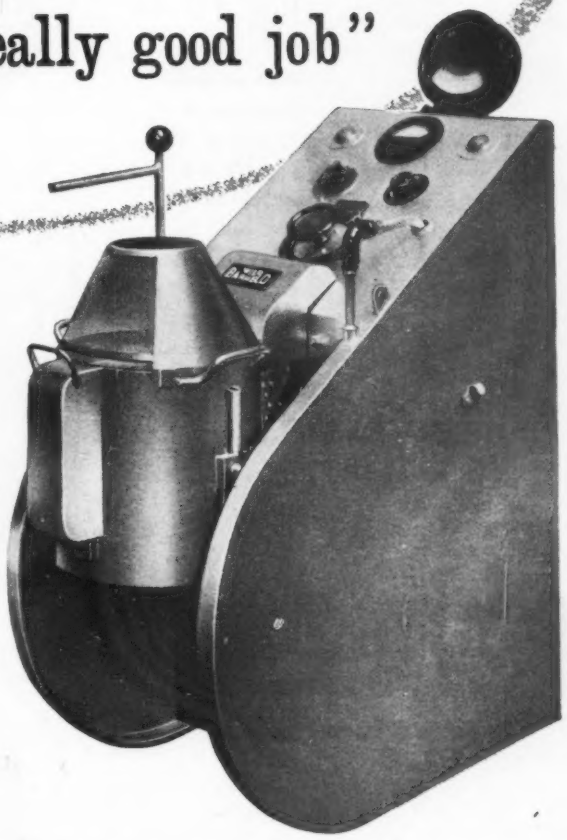
MACHINERY

JULY 9, 1958 ONE SHILLING & THREEPENCE



"These Wild-Barfield furnaces do a really good job"



Where heat-treatment is concerned—are you doing the job as economically as possible? It's surprising the number of people who invest in expensive machine tools for production—and then spoil a good job in outdated furnaces. And the result? Rejects—time, money and probably customer goodwill lost. More and more people are relying on Wild-Barfield equipment. Write for full details and see how you can save by changing to modern electric furnaces.

Self-contained Electrode Salt Bath ESB 346.

ELECTRIC WILD BARFIELD FURNACES

FOR ALL HEAT-TREATMENT PURPOSES

WILD-BARFIELD ELECTRIC FURNACES LIMITED

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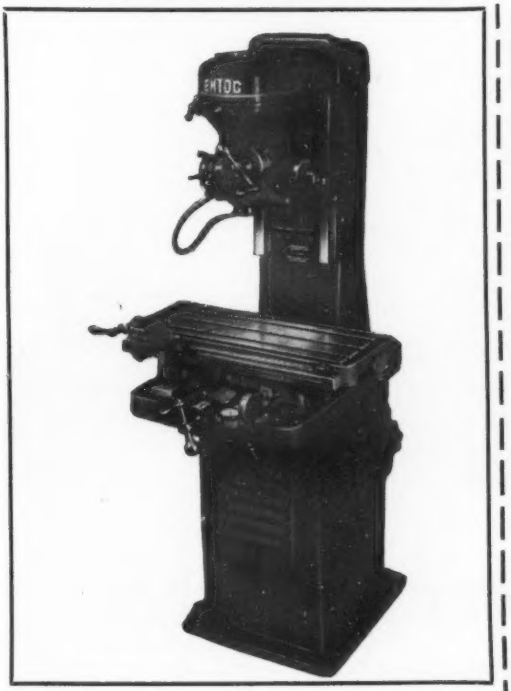
PRECISION *at a price to suit your pocket*

FOR ·0015" ACCURACY YOU NEED AN

EMTOC

CO-ORDINATE BORING MACHINE

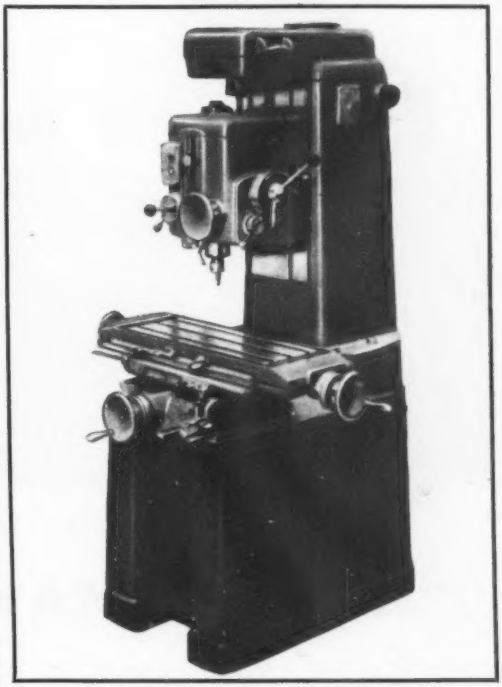


- Built to free expensive machines from small work.
- Boring spindle fitted with slow worm feed and rapid return controls by hand.
- Dial gauges supplied as standard for use with slip gauges.
- Full range of accessories available.

FOR ·0005" ACCURACY YOU NEED AN

ELGAR

JIG BORING MACHINE



- Power feed to spindle 0·0012", 0·003", 0·006" per rev.
- Ground form lead screws, maximum pitch error 0·0005" per ft.
- Dials graduated in 0·0005".
- Measuring system by rod or slip gauges and dial indicator.
- Rapid and fine hand feeds to quill.
- Depth measuring attachment.

BOTH MODELS EX STOCK

ELGAR *RIGHT OPPOSITE NORTH ACTON STN.*

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NRP

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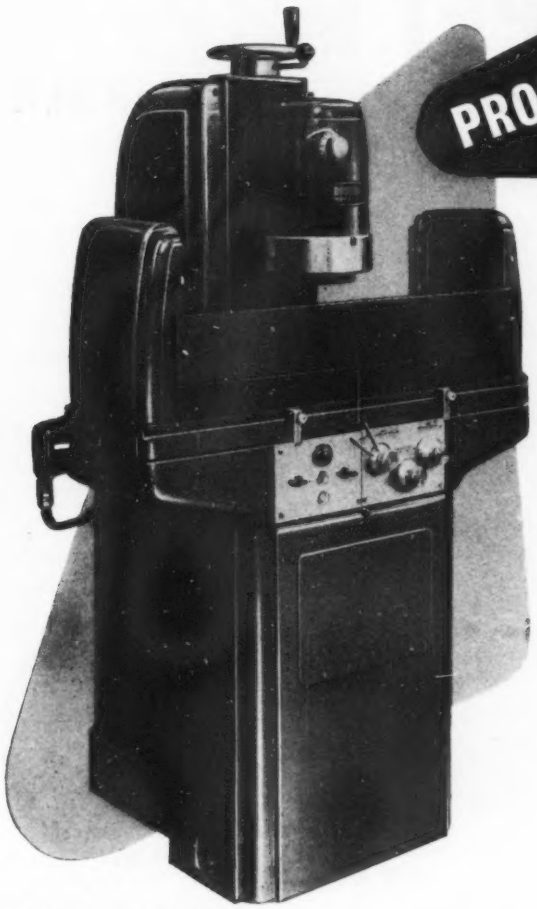
PRODUCTION MASTER

MODEL PM2



HIGH PRECISION HYDRAULICALLY OPERATED VERTICAL SPINDLE SURFACE GRINDING MACHINE

This machine has been specifically designed for production surface grinding operations where a high degree of accuracy and fine micro-inch surface finishes are required.

Under these conditions one P.M.2 is capable of giving an output equivalent of three or even four horizontal spindle surface grinders of the same capacity.

Allow us to carry out grinding tests on your components and submit a full report on the results.

SPECIFICATION

Grinding Capacity	20in. by 6in. by 10½in. under wheel
Table Size	42½in. by 11in.
Longitudinal traverse	25in.
Rate of Feed	5 - 25ft. p.m.
Weight	13¼ cwt. net; 15½ cwt. gross

PROVEN ON THESE RECENT TESTS

- **A 15 hour job reduced to 2 hours.**
- **A surface finish of one micro inch on 2½in. dia. tungsten carbide discs.**

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UNION ROAD, CROYDON, SURREY, ENGLAND

Telephone: **THORNTON HEATH 3221**

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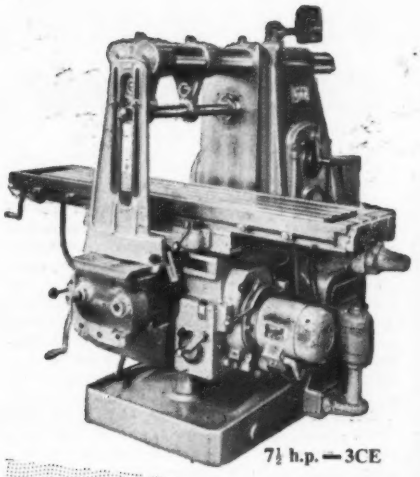


7½ h.p.—3CE

The ever increasing range of C.V.A. Kearney and Trecker Milling Machines, built by C.V.A. Jigs, Moulds and Tools Limited under licence from the Kearney and Trecker Corporation, Milwaukee now includes:

3 h.p. 2CE with 16 speeds

25 to 1,300 r.p.m. (Horizontal) 30 to 1,575 r.p.m. (Vertical)

and 16 feeds — ¼ inch to 25 inch

7½ h.p. 3CE with 16 speeds

25 to 1,300 r.p.m. and 16 feeds — ¼ inch to 25 inch

Both models are fitted with independent feed drive motors and are available as Plain, Universal and Vertical styles. Both Plain and Vertical Machines can also be fitted with automatic cycle table control.

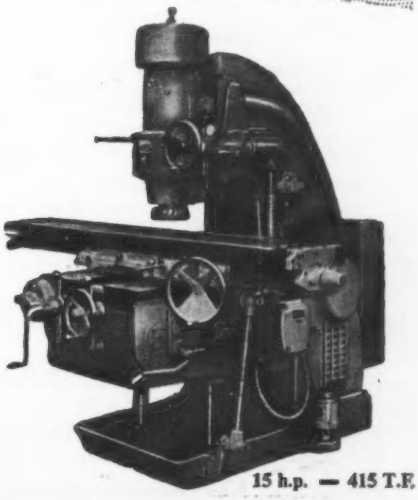
MILLING KEARNEY & TRECKER MILWAUKEE MACHINES

Complete series of Model 3 and 4 T.F. Machines in Plain, Universal and Vertical styles from 10 h.p. to 30 h.p. Monolever and automatic cycle table control is standard on all styles.

The T.F. range features twin vertical screws giving equal weight distribution and increasing stability under the heaviest cutting loads.

Also available is the 2D Rotary Head Machine with its unique action enabling the most complex jobs to be completed in a single set-up.

Write for details of the C.E., T.F. and 2D Rotary Head Machines.



15 h.p. — 415 T.F.

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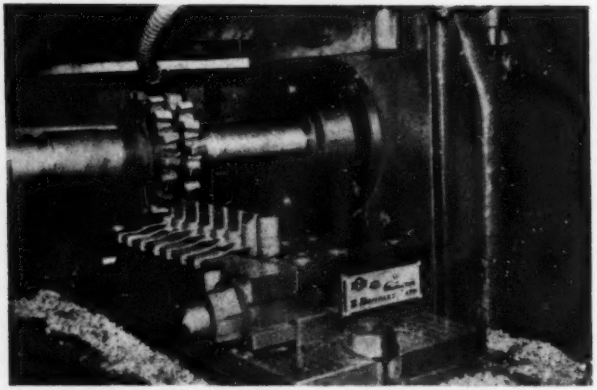
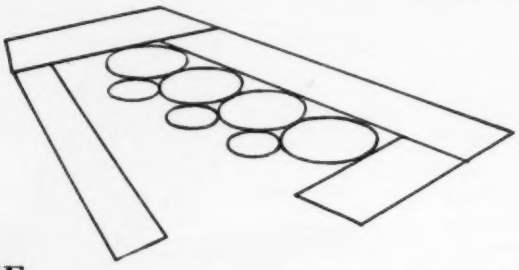
NEW TECHNIQUE SLASHES COSTS IN



THE PROBLEM: Components produced from bar on Capstan, Turret or Automatic lathes very often require some sort of subsequent milling operation. Differences in component diameter will vary with the degree of turning accuracy, but some differences must exist, and the problem is to hold these components securely in a fixture which permits rapid loading and unloading and easy cleaning. The fixture must have a wide capacity range and grip or release a batch of components simultaneously with a simple locking action.

THE SOLUTION: The **Z.B. AUTO-GRIP**, with its system of floating rollers enables a larger number of components to be machined than ever before. The compensating action ensures that every component is firmly gripped irrespective of variations in diameter. This, together with its variable capacity, renders the **Z.B. AUTO-GRIP** the most versatile and efficient milling fixture ever marketed.

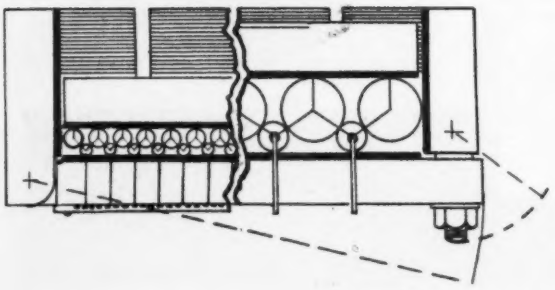
HERE IS HOW THE AUTO GRIP WORKS



The simplified sketch on the left and the drawing below show the basic principles involved. The large diameters represent a horizontal cross section through the components and the smaller, the compensating rollers. If one imagines the swivel arm and rollers removed, and an attempt made to grip the components with the orthodox parallel action vice jaw, it will be apparent that the vice jaw will impinge on the component having the largest diameter, and possibly distort until gripping the second largest: the remaining components are insecure.

With the **Z.B. AUTO-GRIP** system, the swivelling clamp arm exerts its pressure against the floating rollers which automatically arrange optimum pitch and spread the gripping load equally amongst the components notwithstanding substantial differences in diameter. This faculty can be demonstrated to good effect on your own desk, with the aid of a metal template and some coins: we shall be happy to send you a template so that you may prove the Z.B. action for yourself.

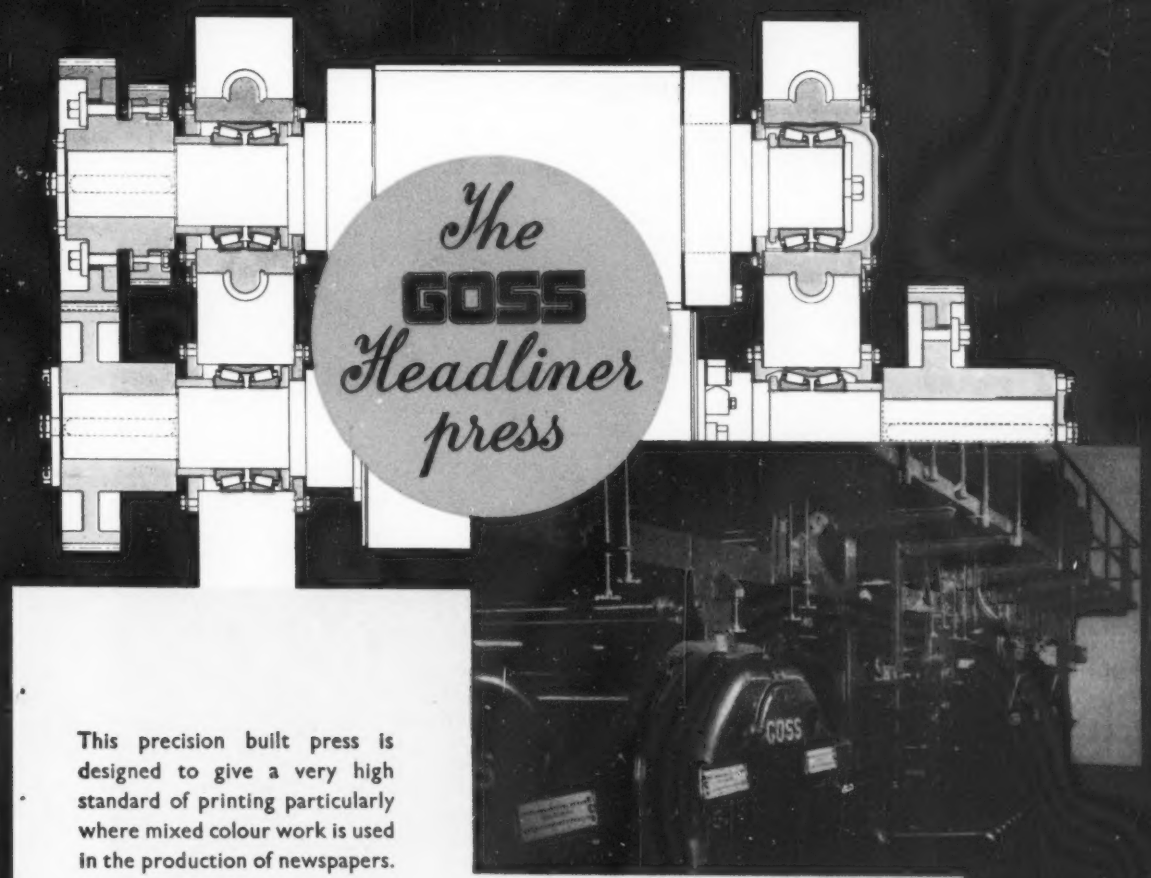
THE AUTO GRIP SAVES TOOLING-TIME-WORRY



SPECIFICATION

Overall length	13½ ins. (343 mm)
Overall width	7½ ins. (190 mm)
Overall height	3 ins. (76 mm)
Size of base	13½ x 6 ins. (343 x 153 mm)
Internal depth	2 ins. (50 mm)
Approx. net weight	41 lbs. (17.6 kgs.)
Max. dia. accommodated	2 ins. (50 mm)

All steel construction: working surfaces hardened: rollers supplied in sets with the following diameters: ¼", ⅜", ½", ⅝", ¾" (7, 10, 13, 16, 19 m/m).



This precision built press is designed to give a very high standard of printing particularly where mixed colour work is used in the production of newspapers.

It includes a number of features which enable the most precise adjustments to be made, and to facilitate colour changes without wastage of ink and labour. The cylinders as shown in the drawing are mounted upon pre-loaded Timken double-cup tapered-roller bearings. Both cylinders are end-located by the bearings at the right, the bearings at the left (although pre-loaded within themselves) are free to float. In this arrangement temperature variation cannot interfere with the bearing tightness; errors in printing register due to play between the cylinders are thus avoided.

The inset housings for the upper bearings have their exteriors eccentric to the bores; a micrometer adjustment for the printing impression is thus obtainable by slightly rotating the housings.

TIMKEN Regd. Trade Mark

tapered-roller bearings

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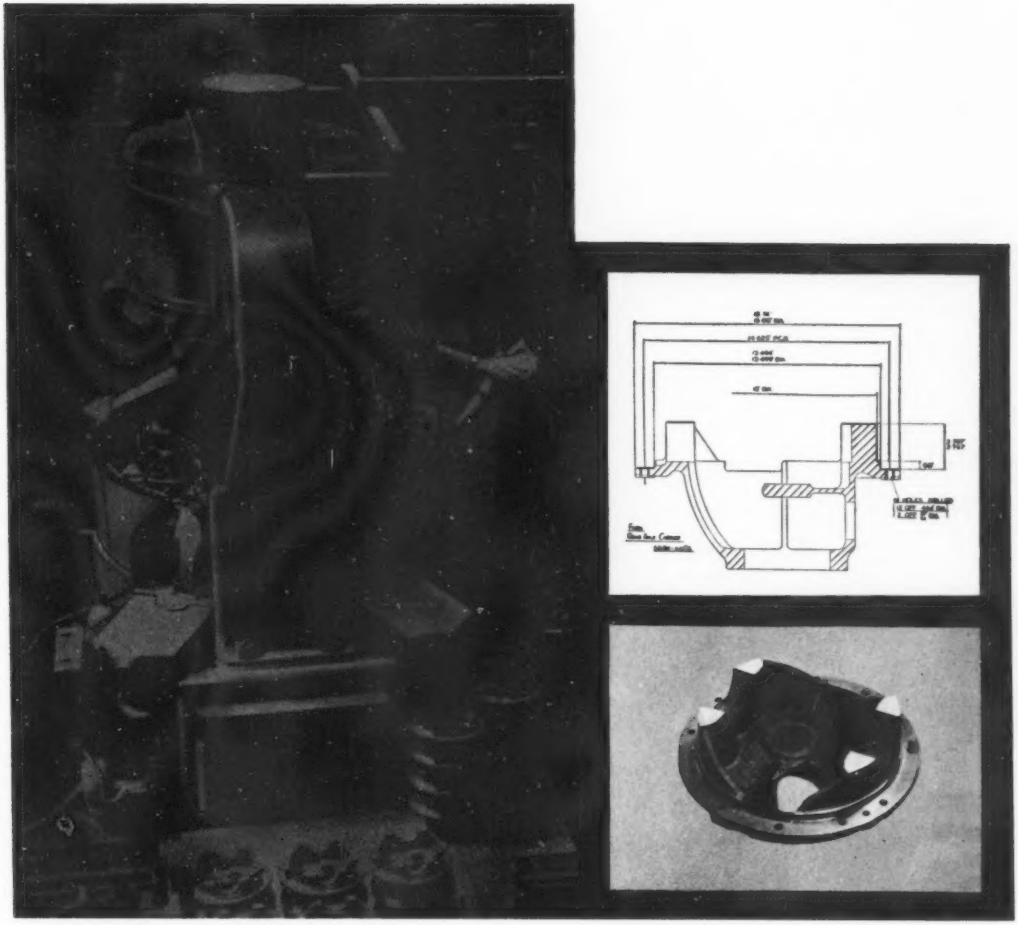


Photograph by permission of Ford Motor Co. Ltd.

Machining of Ford rear axle carriers

This six-spindle No. 10 Verticalauto multi-drills fourteen holes in the component as well as turning and facing.
Hydraulic chucks exert a controlled pressure grip ensuring that there is no distortion.
A 60 h.p. main motor provides ample power for continuous high production.
8 and 12 spindle models are also available.

Ryder VERTICALAUTO

Thos. Ryder & Son Limited, Turner Bridge Works, Bolton, England
Makers also of single-spindle Rydermatics and Piston Ring Lathes

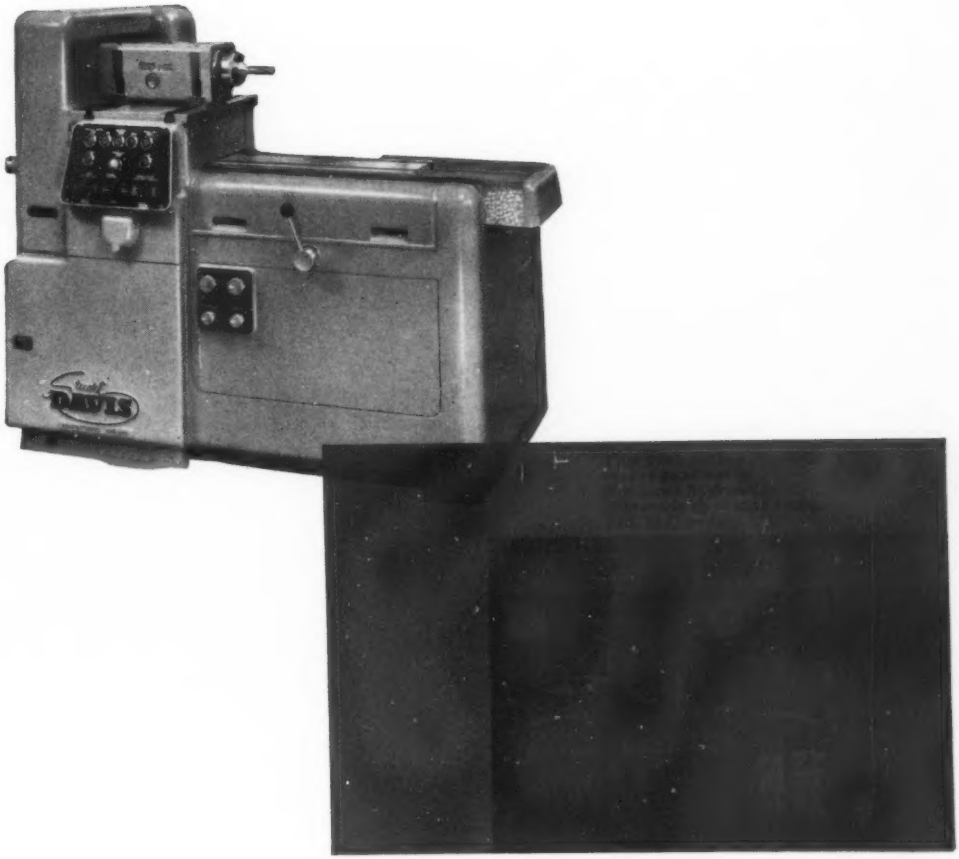
You should have heard the boffins on that controversial subject the other day. Old boffin Sid for example.

He was saying that titanium satellites and nimonic space ships were fair game for SKY-ACKY welding.

"After all," he said, "saucepans, cages, bicycles, motor cars, missiles and aeroplanes are all SKY-ACKY welded."

"You mean SHE-ICKY welded" squeaked boffin Emanuel. Then all the other boffins joined in: "SHE-ACKY," "SKY-ICKY," "SHI-ARKY," "SKEE-ICKY."

I myself pronounce it *SEE-ACKY*, which is, perhaps, how any self-respecting boffin would pronounce it.



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We at Keelavite are a team of experts in the design, installation and maintenance of complete hydraulic systems. We are ready to accept full responsibility for the proper working of all our installations, including all electrical or other control equipment.

Not only this, we are the manufacturers of the largest range of hydraulic units in the United Kingdom.

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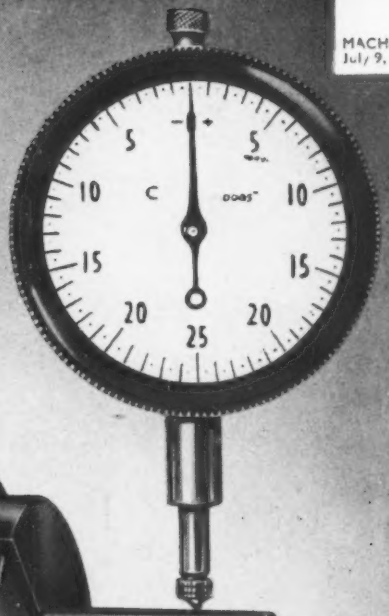

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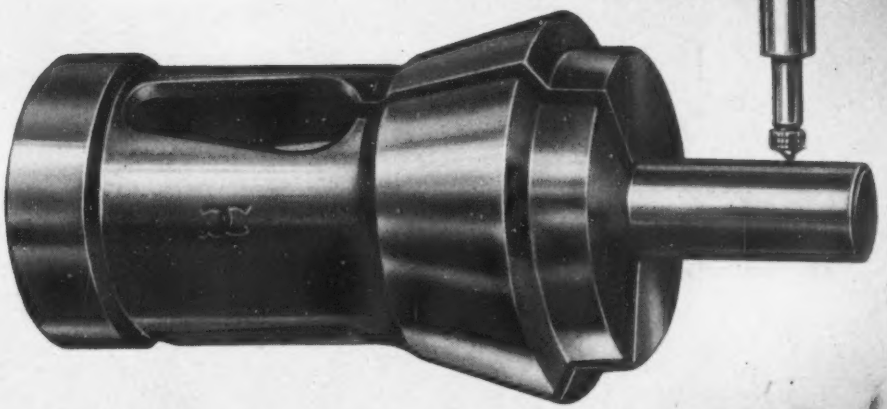
GUARANTEED TO ·001" AT 1" FROM FACE



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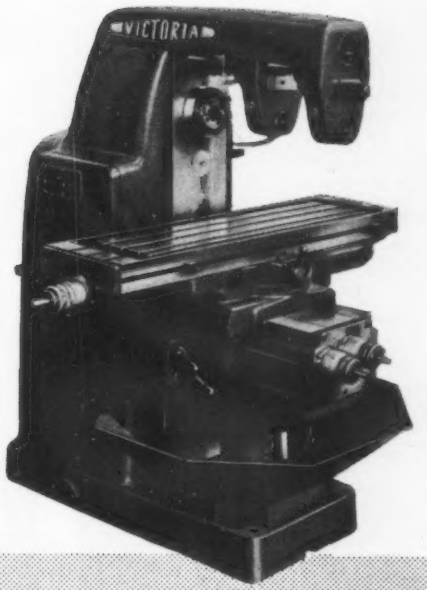


MODEL U.2

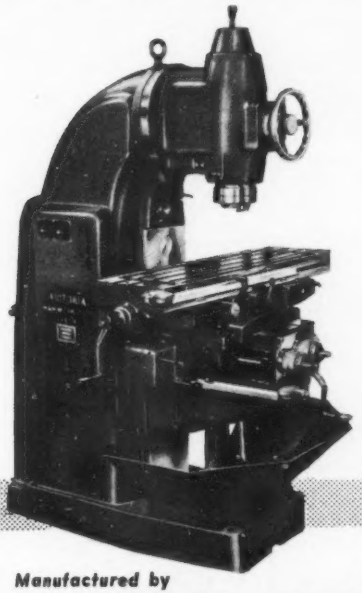
Power feeds to all table movements.

12 spindle speeds, 31-1010 r.p.m.

18 rates of feed, 0.4-12.25 in./min.

4 h.p. motor.

£1135 including 3 phase electrics



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INSPECT THESE MACHINES AT OUR SHOWROOMS
OVER 60 MACHINES UNDER POWER

Manufactured by

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100% ACCURACY AND FINISH

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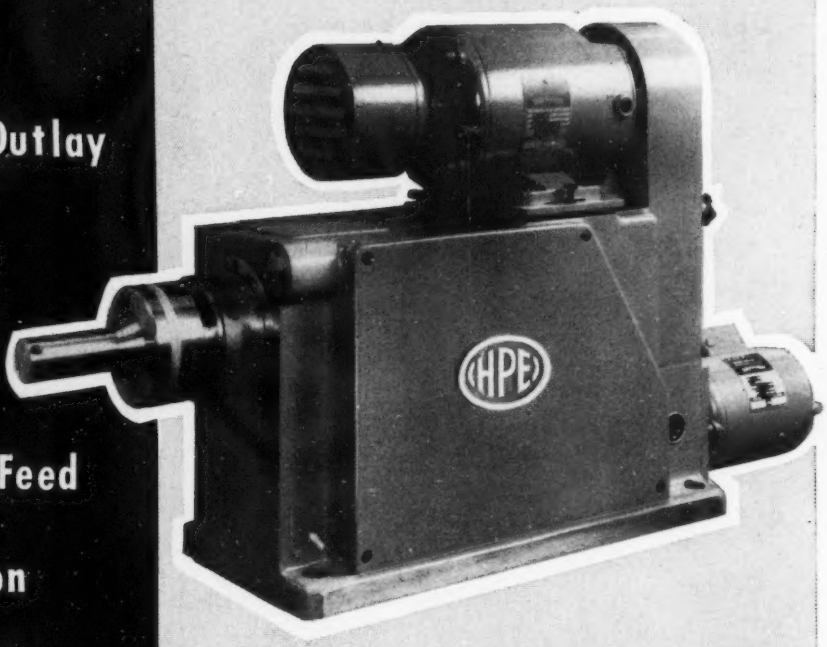

The FB4F Fine Boring Unit Head illustrated above incorporates an independent feed motion, transmitted to its spindle quill through a simple plate cam, which can be designed to give a fast approach and varying rates of feed. The robust spindle and quill, together with super precision spindle bearings, ensure a high degree of finish and roundness.

These self contained units are readily adaptable for a wide variety of applications without need for costly set ups.

Particularly suitable for mounting on simple base plates together with the necessary work holding fixture enabling single purpose units to be constructed for the minimum of time and cost. Wide range of speeds and feeds obtainable by changing feed cam and motor pulley.

"Descriptive brochure on request."

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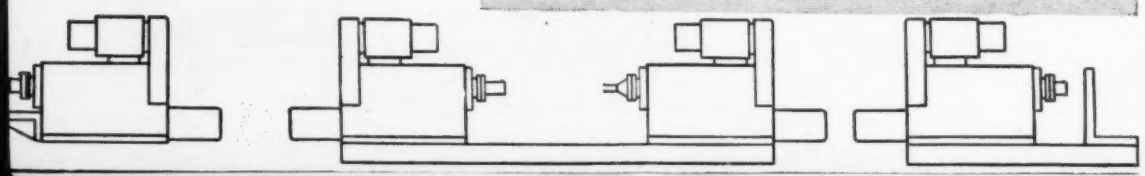

Indicating r.p.m. of electric motor.

Indicating shaft speed, showing use of extension.

Indicating surface speed.

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Run your machinery at the optimum speed for peak efficiency. Any deviation from this speed almost certainly means that it—and you!—are running at a loss.

Cut this loss by making spot checks of r.p.m. with a SMITHS Hand Tachometer. Such a check can be made in an instant, even in unfavourable conditions. What's more, the reading is accurate to within ½%.

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Rotational speeds of shafts, spindles, gears, rotors and rolls.

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Readings can be taken in bad lighting conditions or where the dial is visually obscured.

AVAILABLE IN CHOICE OF FOUR MODELS:—

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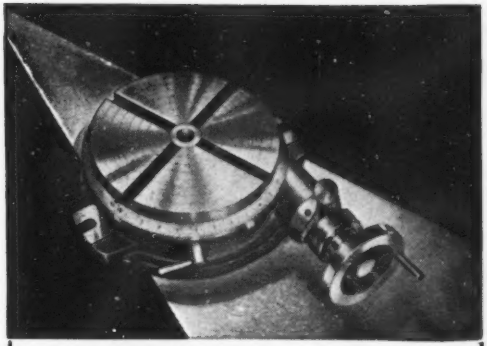

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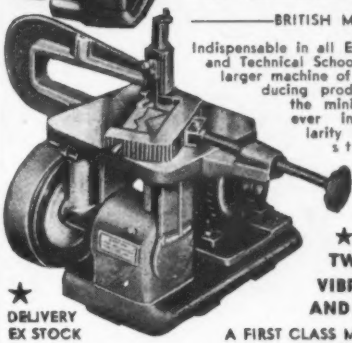

TABLE
12in. × 12in.

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The new ASTRA Vertical Miller Driller For Tool Room Or Production.

★ With left and right hand tracing pin. Table 23" x 8". Spindle No. 3 MT. RPM 296-1964.

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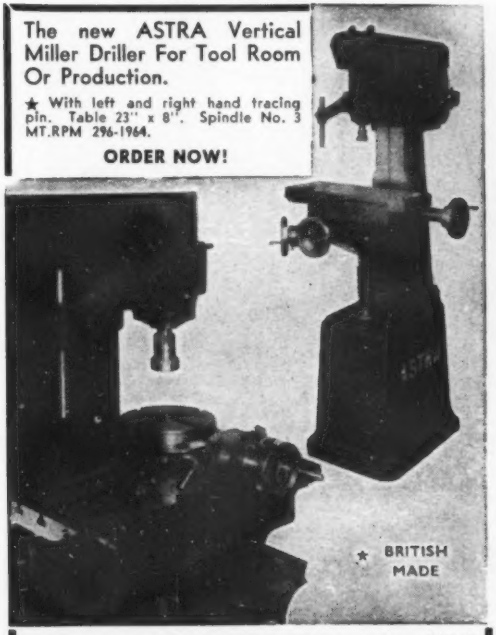

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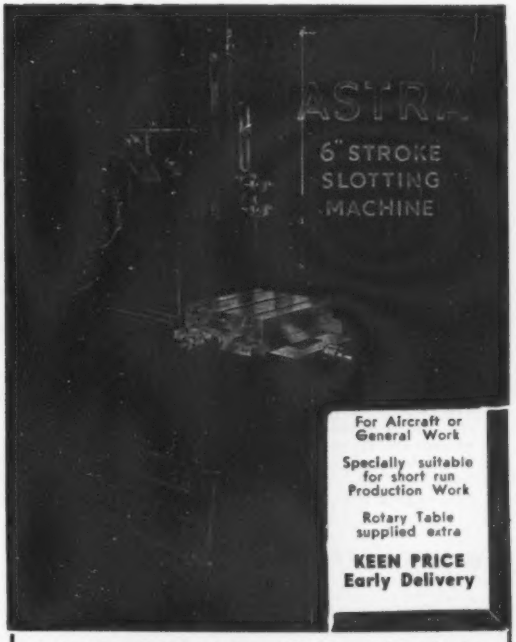

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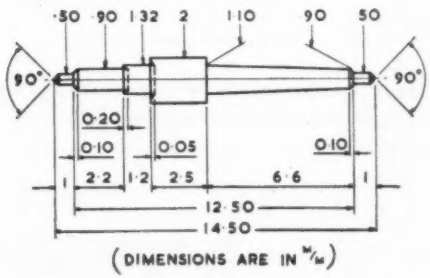

This steel pinion is produced in 36 seconds. Spindle Speed 3545 r.p.m. Cutting speed 74 ft. per min.

Range of machines also available with capacities as above, but fitted with a 6-spindle revolving turret which reduces idle time to the minimum. Eleven tool positions available. Multi-diameter drills and reamers unnecessary. Up to four spindles can be used at one set-up for screwing or tapping.

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AD.231

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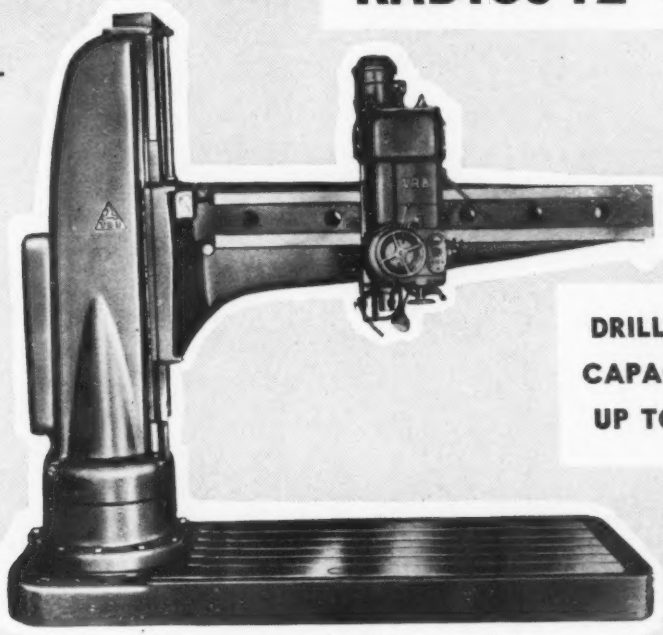
HEAVY DUTY RADIAL DRILLS

RADIUS 12′ to 14½′

MODEL

VR84



DRILLING CAPACITY UP TO 4″

EARLY DELIVERY ● COMPETITIVE VALUE

- Centralised arrangement of controls
- Wide range of pre-selected spindle speeds
- Wide range of power feeds
- Power locking of sleeve on column

EXCLUSIVE DISTRIBUTORS IN THE UNITED KINGDOM

SPECIFICATION	VR.83	VR.84	VR.103	VR.104
Drilling capacity, steel	3¼″	3¼″	4″	4″
Max. radius of Spindle	11′ 10″	14′ 8″	11′ 10″	14′ 8″
Min. radius of Spindle	3′ 3½″	3′ 3½″	3′ 3½″	3′ 3½″
Spindle bored	No. 6 Morse	No. 6 Morse	No. 6 Morse	No. 6 Morse
Spindle speeds (14) Range Standard ...	11.2-1000	11.2-1000	11.2-1000	11.2-1000
High	16-1400	16-1400	16-1400	16-1400
Nett Weight	14 tons	16 tons	14½ tons	16½ tons

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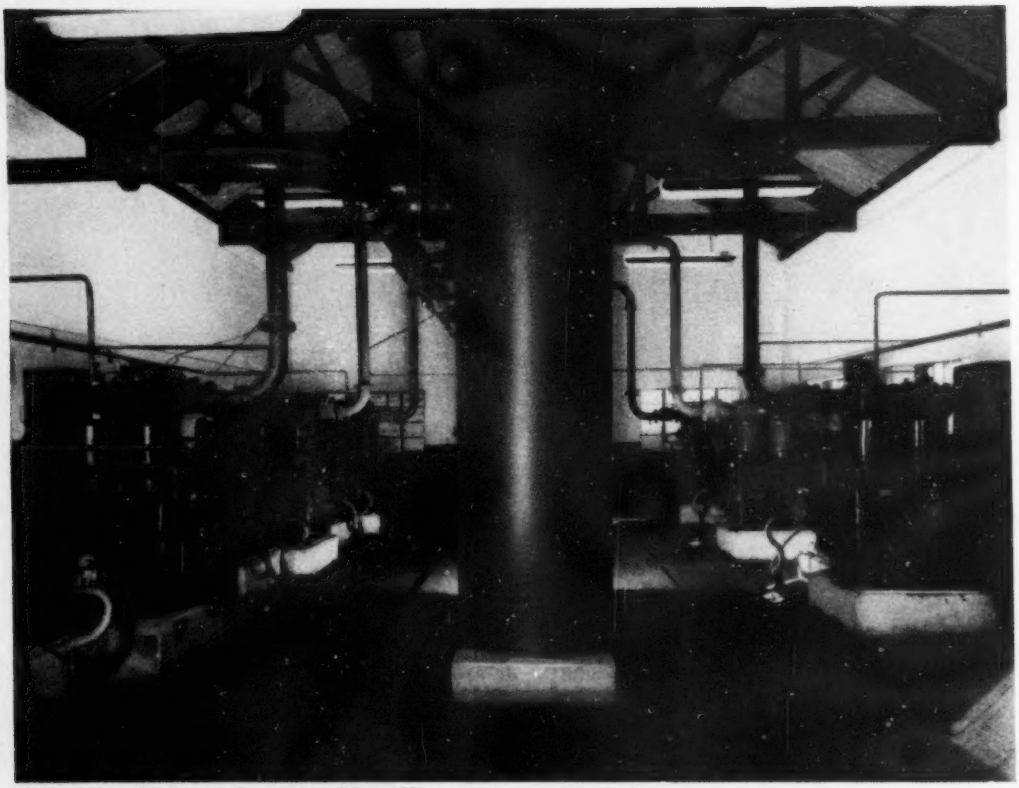

Each of these EH 241 Air Compressors delivers 330 cu. ft. free air per minute.

MARSTON VALLEY FLETTONS ARE SANDBLAST-FINISHED WITH "BROOMWADE" COMPRESSED AIR

A battery of seven "BROOMWADE" EH 241 Stationary Air Compressors is used for sandblast-finishing many of the Fletton bricks made at the Ridgmont works of the Marston Valley Brick Co. Ltd.

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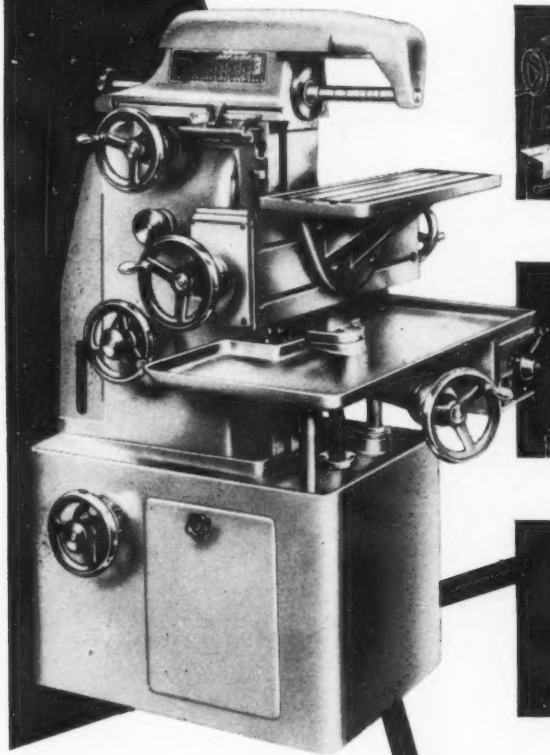
Type U-OA Universal Milling Machine

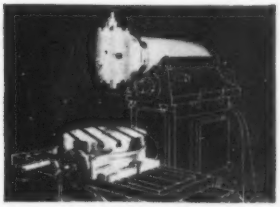
WITH TABLE SWIVELLING IN THREE PLANES

A SWISS PRECISION MACHINE

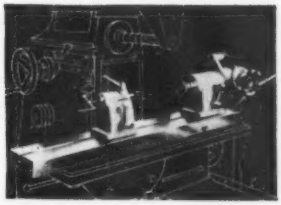
CHRISTEN

This modern, well-designed machine is especially suitable for Toolmaking and for high precision production work

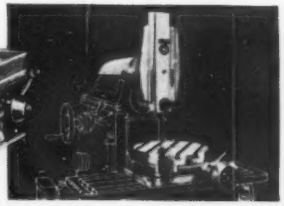




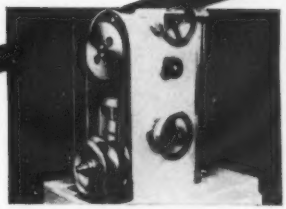
Vertical Milling Head & Universal circular table



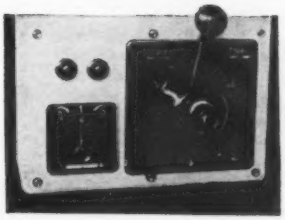
Universal Dividing Head on auxiliary swivelling platen



Slotting Head & Circular Table



Infinitely variable speed range from 60 to 2,500 r.p.m. Infinitely variable feed from separate fitted motor



Patented single lever switch for easy control of milling spindle rapid traverse & power feed

Table Size 26¾in. by 9in.

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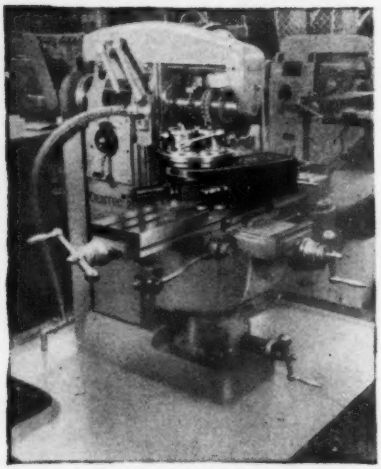
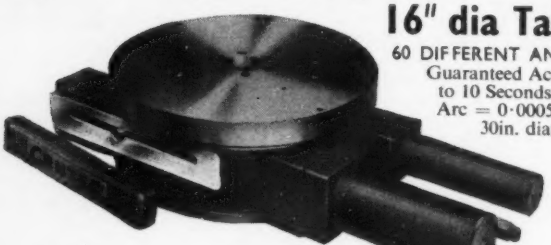
CENTEC AUTO-PNEUMATIC Index Tables★



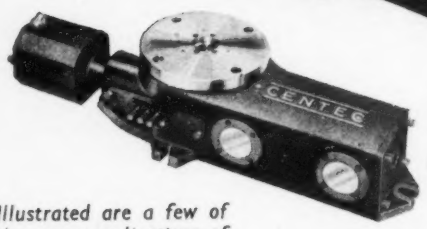
★Used as a four-station transfer mechanism for components milled on a 'Centec' Milling Machine. By kind permission of Messrs. Belling & Lee Ltd., Enfield.

. . . for VERY FAST INDEXING of different angles with great accuracy



16" dia Table

60 DIFFERENT ANGLES
Guaranteed Accurate to 10 Seconds of an Arc = 0·0005 in. at 30in. diameter.



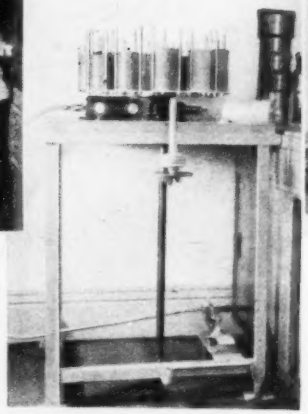
8" dia table

5 different angles

UP TO 100 TIMES PER MINUTE

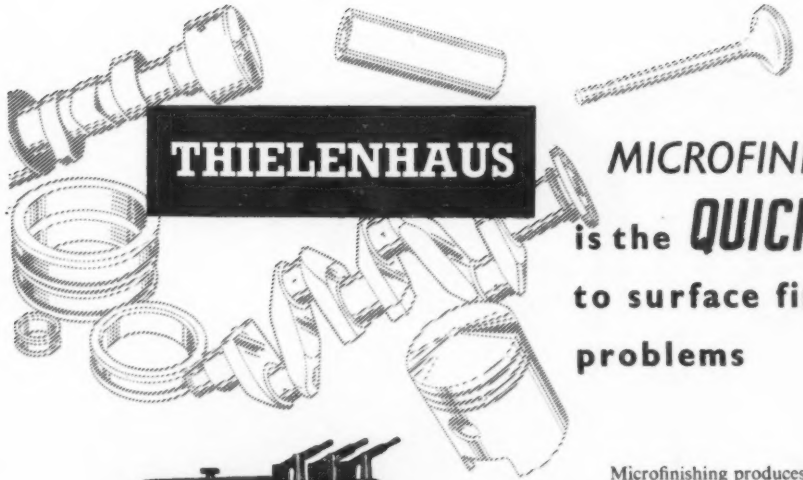
Illustrated are a few of the many applications of the Centec Index Tables. Descriptive leaflets on these and our other machines are available on request.

★ Assembly fixture, foot valve operated, for consecutive selection of different discs in correct sequence to build up filters. By kind permission of Messrs. British Filters Ltd., Maidenhead.



★ Used for milling squares on 'Centec' Automatic Milling Machine. Movement if the machine table triggers indexing by means of a cam valve.

Made by CENTEC MACHINE TOOLS LTD • CENTEC WORKS • HEMEL HEMPSTEAD • HERTS • Boxmoor 584-5-6



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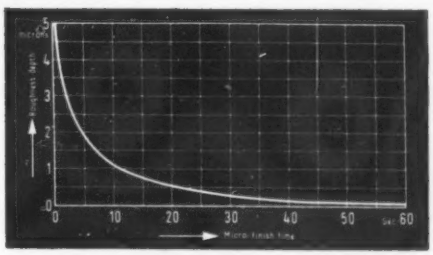
MICROFINISHING is the *QUICK* answer to surface finishing problems

Microfinishing produces smooth, high percentage bearing surfaces with sound crystalline base structure, greatly extending the life of highly stressed parts, which with production rates possible on Thielenhaus machines offers the two-fold gains of :

Improved functional quality and
Higher production.

This graph shows the relationship between surface roughness and microfinishing time. The rough surface of coarse peaks and valleys is quickly reduced and a roughness in the order of 12 M.I. (RMS) achieved in about 10 seconds. As the bearing portion increases so does the amount of material to be removed and the time required.

Roughness values between 1 and 2½ M.I. (RMS) can be produced on automobile crankshafts in a machining time of between 40 and 60 seconds.



The centreless machine illustrated is designed for small and medium sized components requiring either continuous or plunge-cut finishing. It is made in three sizes up to 5" dia. capacity. Thielenhaus machines are also available for micro-finishing crankshafts, camshafts, brake-drums, pistons, bearings and races, etc. A descriptive catalogue will be gladly sent on request.

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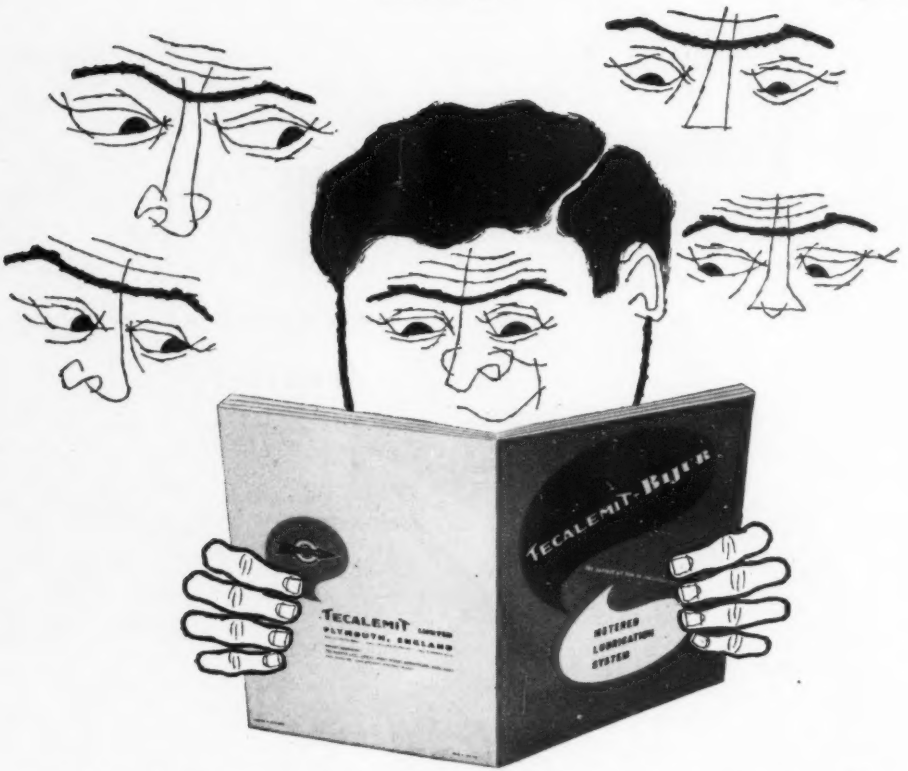

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Tecalemit-Bijur metered lubrication has been proved successful in thousands of installations, from industrial sewing machines to transfer machines, it automatically provides the correct amount of clean, filtered oil to all moving parts, giving higher speeds, heavier loadings, longer runs, and above all, longer machine life.

Write for this new book *containing full detailed information including:—*

Automatic and hand-operated lubricators.
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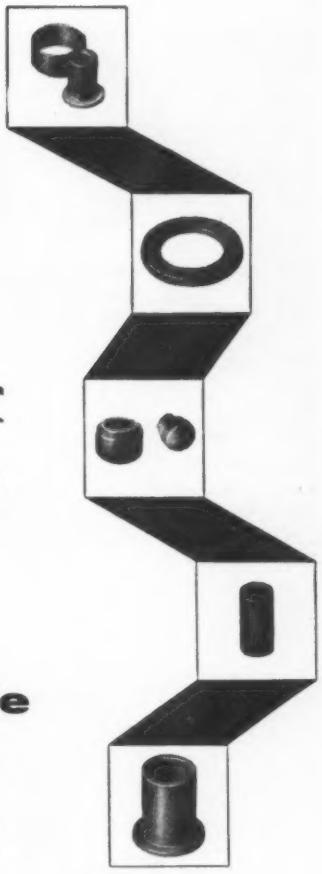


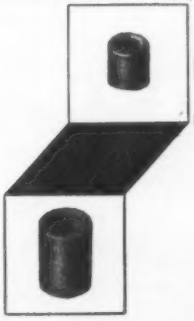
. . . it's standard size but completely inaccessible

Obviously a case for an oil-retaining bearing—that will cut out lubrication and maintenance.
With these oil-impregnated sintered-metal bearings the oil is fed to the surface by capillary action so that you can get controlled, trouble-free lubrication—automatically.

. . . you should specify *Reservoil*

Sintered-Metal **OIL RETAINING BEARINGS**

There are a variety of shapes and many sizes of "RESERVOIL" bearings for every normal medium duty, but particular attention is drawn to the large range of plain cylindrical bearings to B.S.I. standard dimensions. Most sizes are held in stock.



Please write or 'phone for Technical Brochure SD.40 or Catalogue of sizes SD.41

The Morgan Crucible Co. Ltd. Battersea Church Road, London, S.W.11
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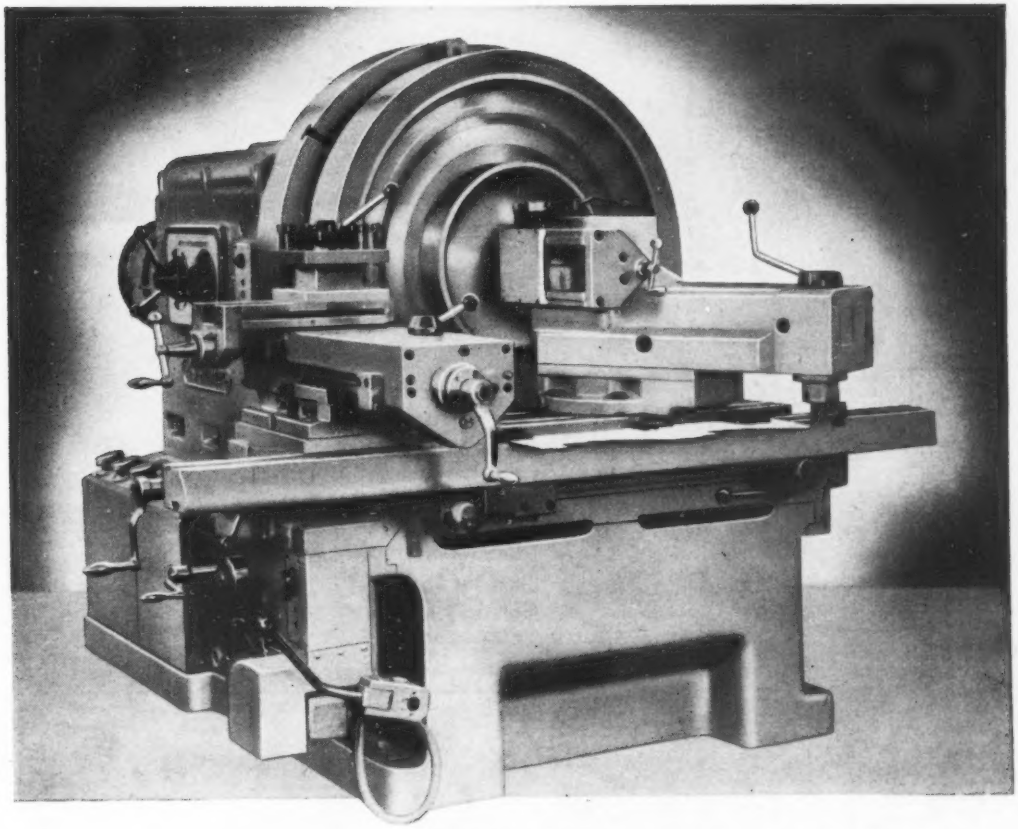

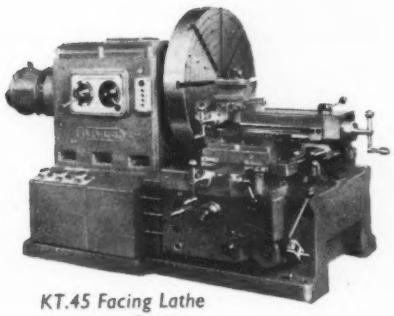

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RAVENSBURG KT.45 FACING LATHE

with hydraulic copier and additional front toolpost, for turbine discs, moulds, etc.

Max. turning diameter	42″
Speed range	8.4 - 380 r.p.m.
Gap width in front of faceplate	17¾″
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Longitudinal adjustment of copying tool	6⅞″
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In the Centricator only the feeler is rotated—the dial indicator remains stationary. This leads to important advantages; indicator readings are parallax free—both hands are free for positioning the work—misalignment of the work shows up instantly on the stationary indicator.

Centering accuracy of 0·0001" can be obtained with the Centricator, and the instrument can be used for either internal or external centering, for squareness testing and for true running tests.

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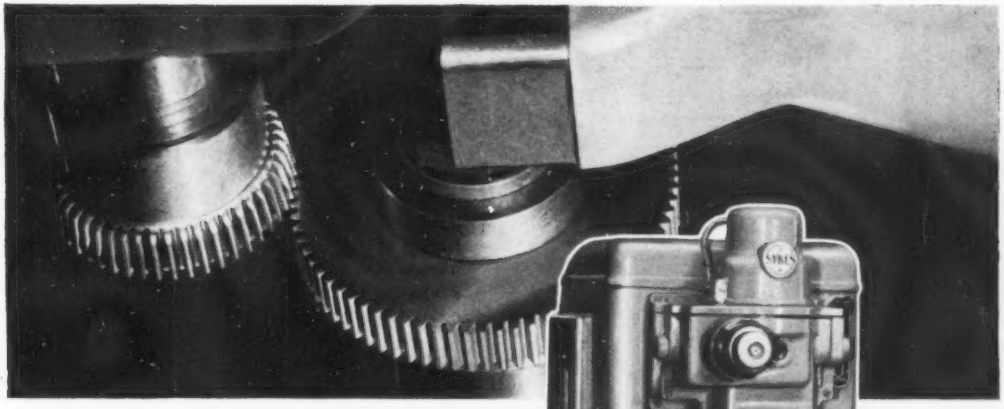

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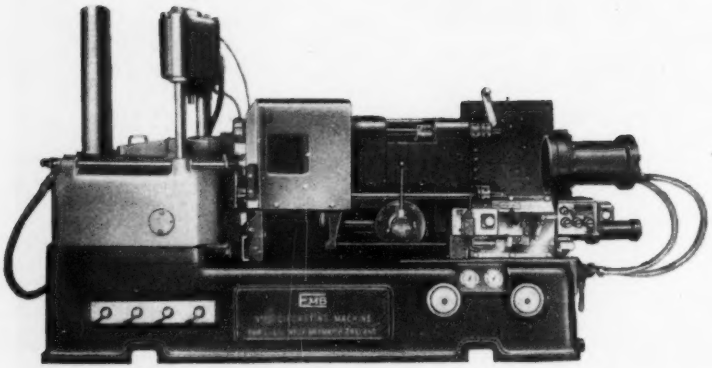

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of less hours and higher pay with E.M.B. diecasting machines.

They have been designed with the emphasis on rapid production of high quality castings in zinc alloy, aluminium and brass.

An automatic No. 10 hot chamber machine will do 13 shots per minute *automatically*.

Are your machines up to this speed?

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Size of Machine	No. 6	No. 10	No. 14	No. 20
Capacity in zinc base (lbs.)	¾	2¾	7	12
Capacity in Aluminium (lbs.)	—	1¼	4½	8
Max. die size (ins.)	8½×9½	16×10	24×14	30×20
Stroke of Platen ...	4½	6	9	12

On all but the No. 6 machine, transposing heads will cater for zinc base and aluminium alloys on the same machine.

E.M.B. Co. Ltd.

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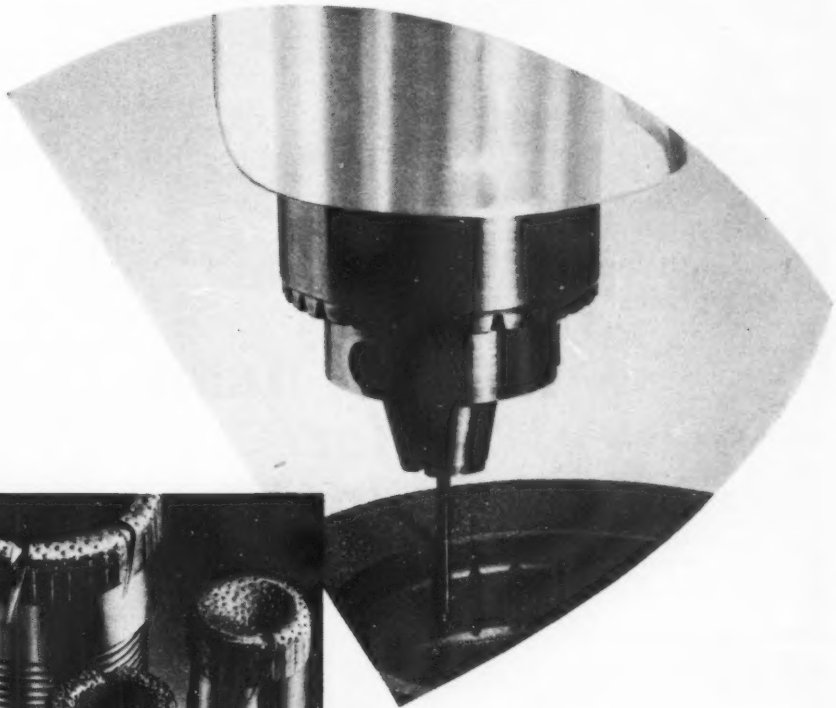
DIAMOND *cut* DIAMOND

We use our own products



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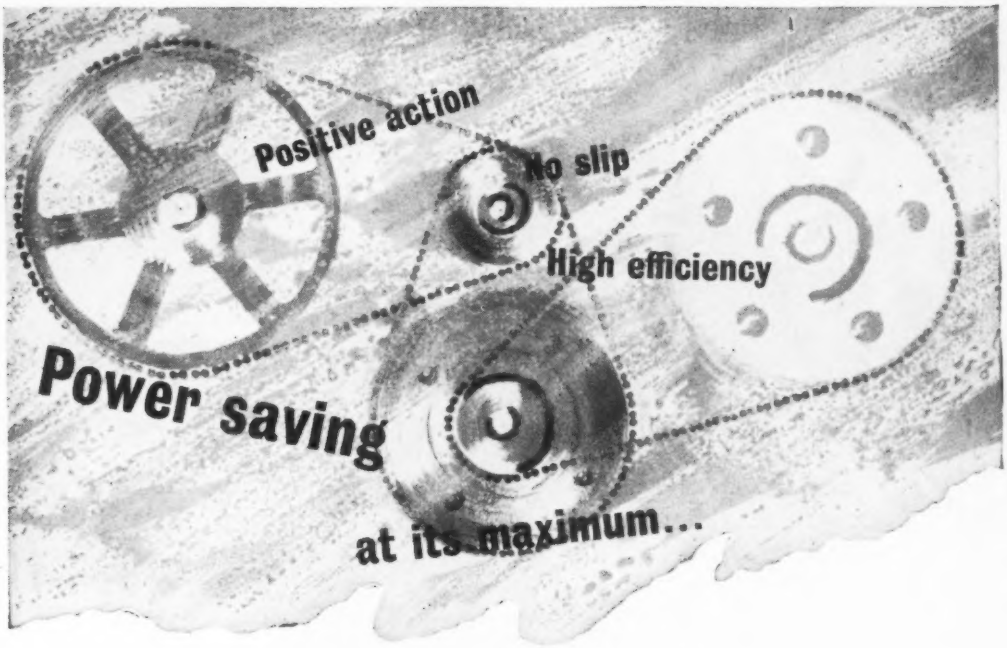

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Renold chain drives have a certified transmission efficiency of 98.5 per cent, unequalled by alternative forms of " off the shelf " power transmission.

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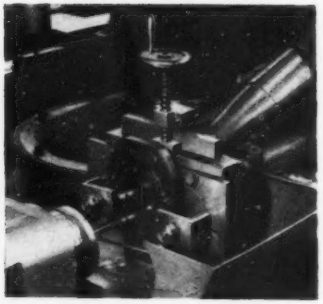
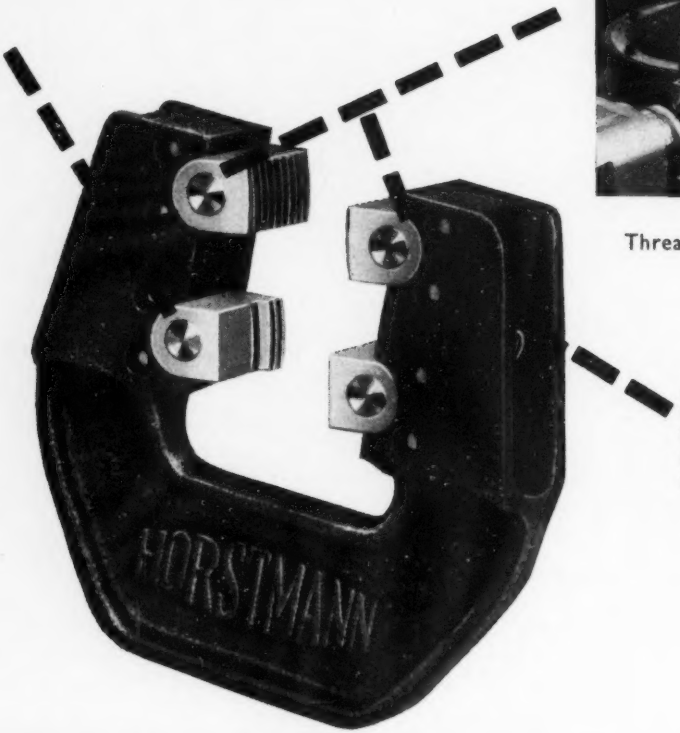
The reduced thread face of the anvil eliminates all shearing action, a particular advantage when gauging soft metals.



Thread grinding the anvils.



As there are no projections from the side of the caliper frame, it is suitable for gauging shouldered work.

Featuring Horstmann gauges

The Horstmann Model 52 Screw Caliper Gauge puts accuracy in your hands. In addition to the features displayed above, it incorporates many other advantages, all of which contribute to fine accuracy, versatility, long life and ease of handling. The anvils are set so that they do not roll—all shearing action is eliminated—the caliper is suitable for either left- or right-hand threads—and it is ideal for gauging Acme forms and shouldered work. Model 52 is available in a full range of B.A., American, Unified, Whitworth and Metric forms of thread.

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The modern HYDRAULIC PRESS

for a wide variety of applications from one ton up to 300 tons capacity

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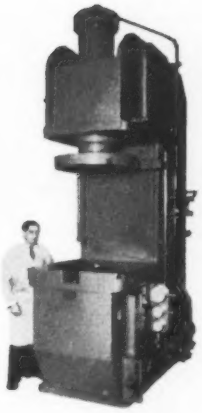
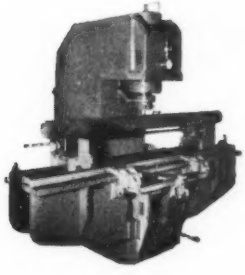
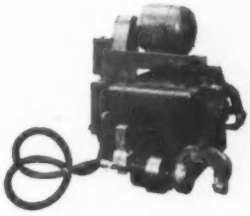
Write to-day for details of Hi-Ton Presses and mention the type of presswork application in which you are interested.



Hi-Ton 150-ton Open Throat Drawing Press.

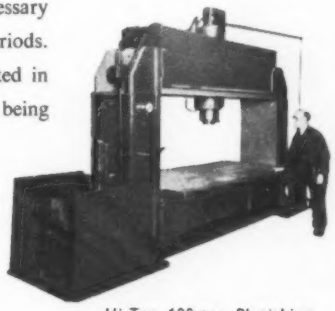


Hi-Ton 75-ton Press equipped with hydraulically operated loading equipment enabling bars to be loaded onto the straightening equipment outside the throat area of the machine.



Hi-Ton HTR.20 Riveting Unit consisting of pump unit and cylinder assembly.

Hi-Ton Indexing Table Machine with two down stroking rams each of 15 tons capacity



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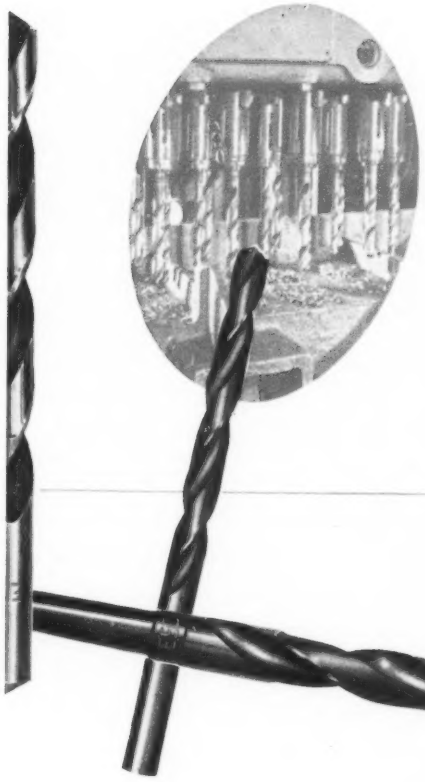

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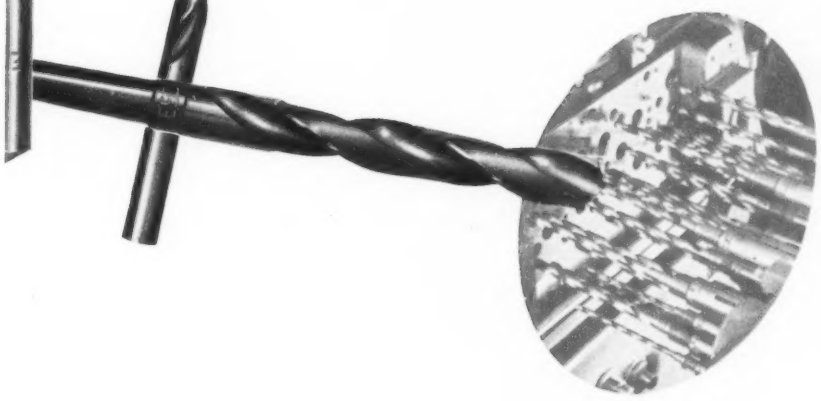

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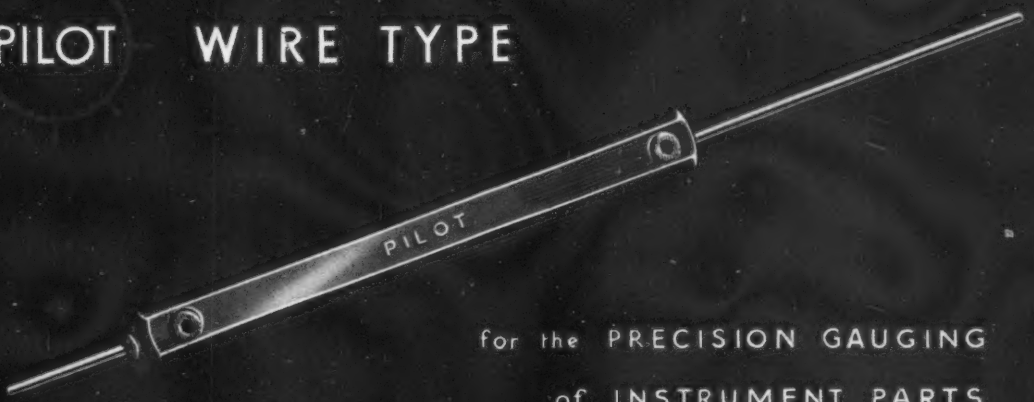

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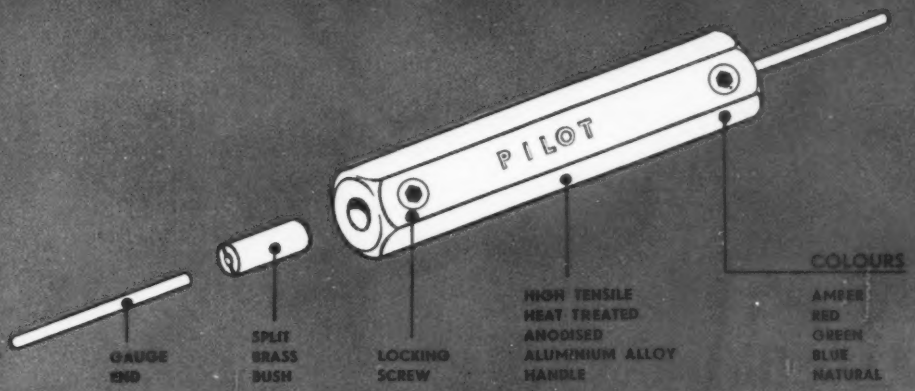

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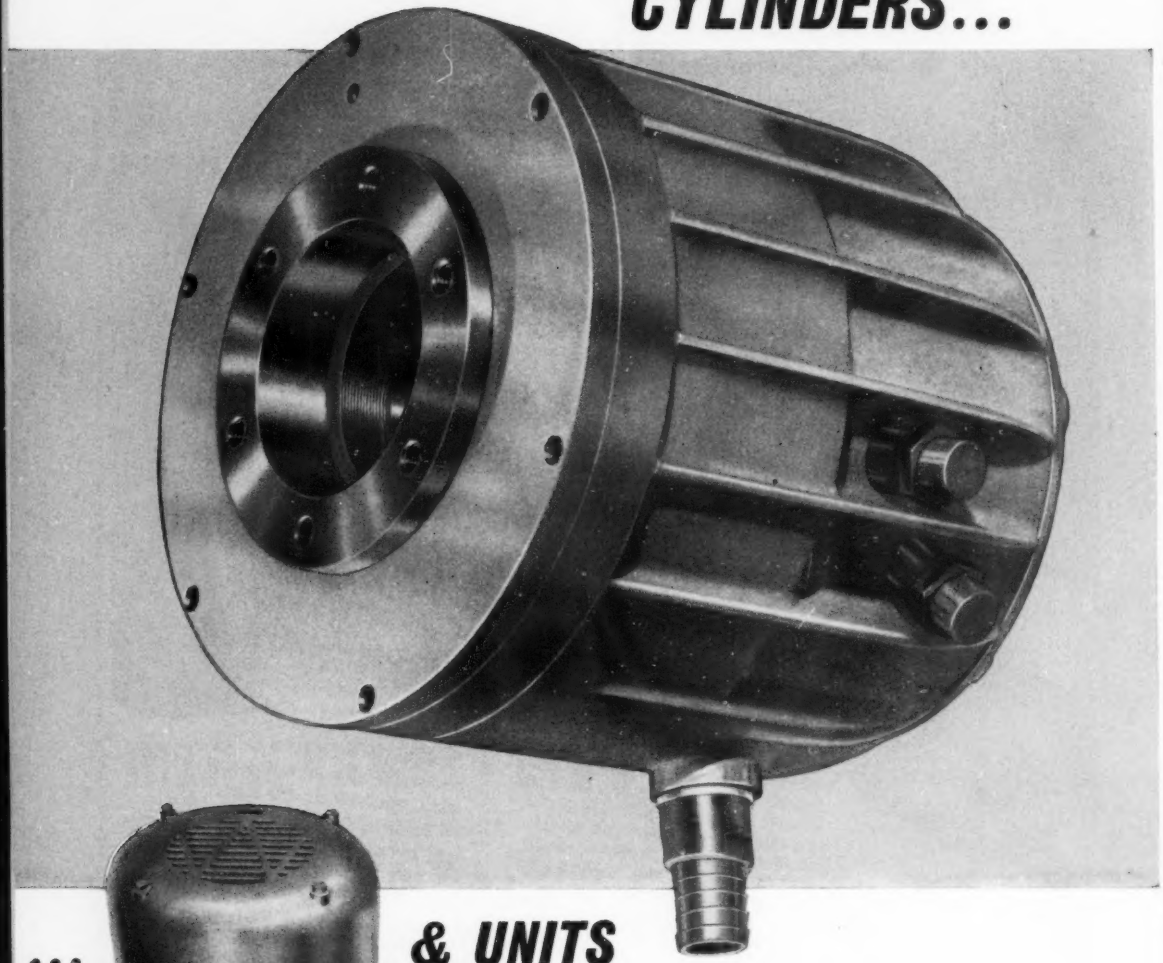

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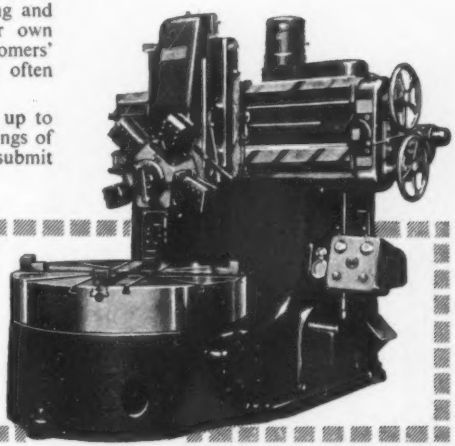

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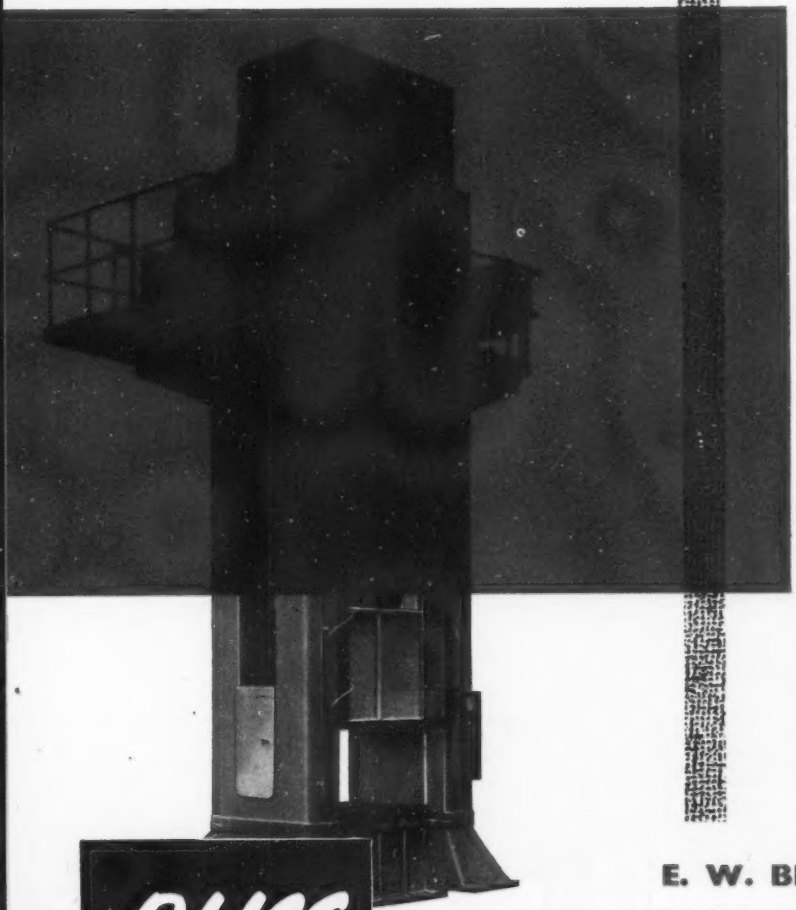

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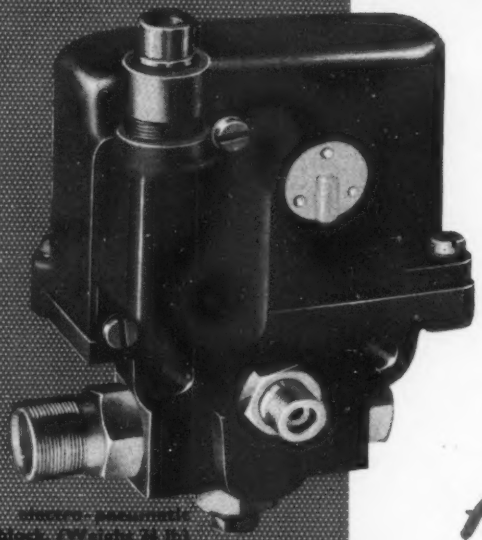

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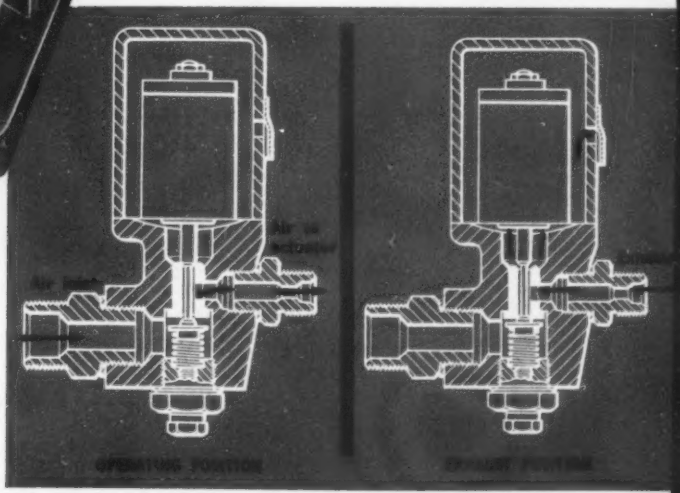

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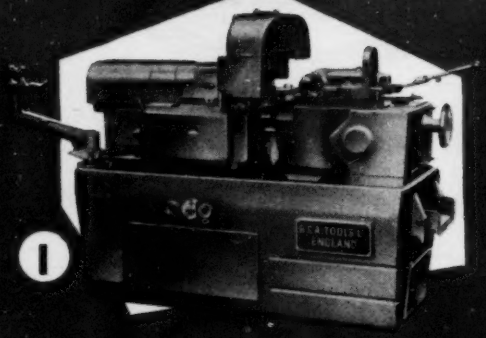

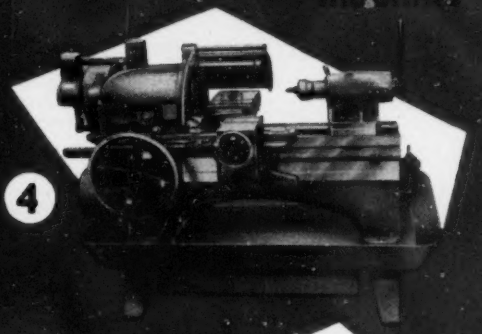

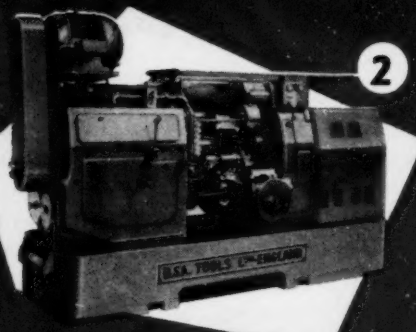

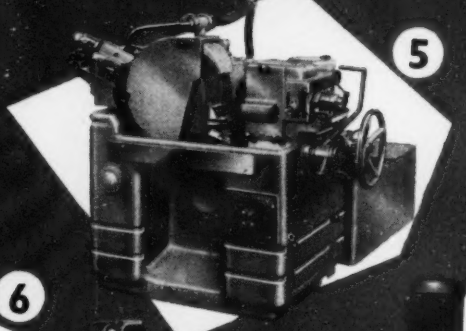

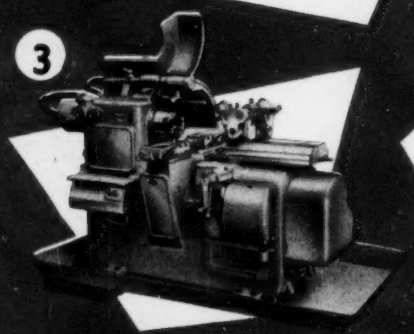

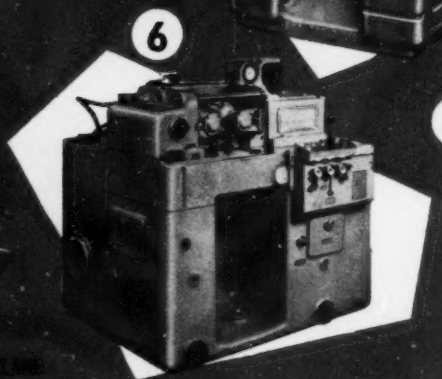

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CONTENTS

Abstracts of Principal Articles

The Production of Calculating and Ticket-issuing Machines ..... P. 60

In addition to the well-known punch, from which their name is derived, the Bell Punch Co., Ltd., Uxbridge, produce an extensive variety of calculating and ticket-issuing machines, taximeters and aircraft instruments. These products incorporate many pressings, which are produced in a well-equipped section of the company's works. Among the parts produced on a 50-ton C.V.A. dieing press, are key bars, which are of a complex shape and must be made to close limits. Another complicated pressing is the frame plate, several of these components being used on each calculating machine. After pierced blanks have been produced by a multi-stage tool, they are bent to a channel section, and certain slots are pierced in a hand-fed tool, which incorporates banks of horizontally-moving punches. To guard against faulty location, this tool has two sliding blades which must be moved inwards to trip limit switches, before the clutch mechanism of the press can operate. Key stems are produced in large quantities, and one design is made by piercing, cropping and swaging operations on a multi-stage tool. Another type is made from strip material on a compound tool, a micro-switch being fitted to stop the machine before the end of the strip is reached, and thus prevent the formation of half-blanks. Gear pressings are blanked and then shaved, to maintain the close limits and ensure smooth surfaces, and an infra-red oven is used for pre-heating plastics materials before they are worked to prevent cracking and to reduce the loads on the machines and tools. For parts that are required in small batches, the company employs Crosland tools made of densified wood, with steel strip cutting members. (MACHINERY, 93—9/7/58.)

Some Standard and Special Machine Tools Built in the TOS-Kurim Factory, Czechoslovakia ..... P. 77

The TOS-Kurim machine tool works, originally the Zbrojovka machine tool and armament factory, now provides employment for about 3,000 people and is stated to be the largest and most up-to-date plant of its kind in Czechoslovakia. Here, an important activity is the design and construction of special-purpose machines incorporating unit heads. In addition, plano-type and knee-type milling machines, and horizontal borers are made. There is a large, mechanized iron foundry for the production of high-quality machine tool castings, and the methods employed in the light and heavy machine shops and assembly shops are in accordance with modern requirements. Some details are here given of the production activities, with particular reference to recently-introduced heavy-duty knee-type milling machines with hydraulic motor and lead-screw feed motions, and special-purpose machines for a variety of applications. The latter include an in-line transfer machine which has been built to the order of a well-known firm abroad for machining cast-iron housings for railway axle boxes. (MACHINERY, 93—9/7/58.)

Savings in Material and Production Costs by Flow Turning ..... P. 87

It is explained that in flow turning or "rotary extrusion" metal is deformed in shear under pressures ranging up to 50,000 lb. per sq. in. Reductions in thickness of 75 per cent or more can be obtained in one pass and as a result of cold working, the tensile strength, fatigue resistance, and hardness of the metal are substantially increased. Suitable operating conditions are indicated, and it is stated that inside diameter and wall thickness can readily be held within limits of $\pm$ 0·002 in. Advantages of producing parts by this method are discussed in connection with an intermediate bearing support which is flow turned from a flat forging; a bullet-nosed combustion chamber liner, formerly made in two portions and assembled by fusion welding; a rear bearing support; and a long drive shaft for a gas turbine. For the latter component, a 43-in. long, upset, pierced forging is employed. The finished length is 76½ in., and no subsequent operations are required on the internal surfaces. (MACHINERY, 93—9/7/58.)

Micyl Blocks for Measuring Tapers... P. 93

Reference has previously been made in MACHINERY to the Micyl blocks developed by Laboratoire Central de l'Armement, Paris. These blocks are now available in this country and the latest design is here described. Particulars are included for three sizes, and reference is made to a special stand which has been introduced to facilitate checking tapered components where the large diameter end face is the datum surface. (MACHINERY, 93—9/7/58.)

The Use of Metal-reinforced Plastics for Dies ..... P. 97

Good results are being obtained with press tools of various types made from a new metal-reinforced plastics material known as Epoxy-Alloy. This material comprises an epoxy resin with fibres of steel or aluminium, or a combination of glass and steel. Fibres of the type produced by the steel wool process are employed, and the procedure for tool making differs somewhat from that normally followed with plastics. A surface coating of resin is first applied to the mould and "flocked" with short steel fibres by a spraying process. Additional resin is then poured into the cavity and the mass of reinforcing fibre is subsequently pressed into it by means of a hardwood plug, the pressure being maintained during the curing stage. In some instances, glass fibre may by substituted, with advantage, as reinforcement for the body of the tool. When aluminium fibre is used, the mixture has good thermal conductivity, and may be employed, for example, for the production of heated, matched moulds, and vacuum forming moulds. Epoxy-Alloy tools are more expensive than those made by casting compounded epoxy resins in the normal manner, but may have considerably longer life. (MACHINERY, 93—9/7/58.)

Determining the Effects of Mechanization on Production Costs

During recent years there have been rapid advances in the design of equipment for performing operations automatically in both production and assembly departments. Such equipment, in many instances, is necessarily much more elaborate than that previously employed for accomplishing the same results, and both initial and subsequent maintenance costs may be correspondingly high. On the other hand, very important savings in direct labour costs may be achieved as a result of automation, and these savings may far outweigh possible increases in machine depreciation and overhead charges per unit of output. It is very desirable that mechanization should proceed as rapidly as is economically justifiable. At the same time, it is obviously undesirable that complicated arrangements should be put into operation, if the effect, when proper account is taken of all relevant factors, is to increase and not reduce unit costs.

In this connection, it was pointed out by Mr. A. J. Dunkle, during the course of a paper presented to the American Society of Mechanical Engineers, that it is most important to obtain a true picture of the overall results that may be anticipated from a proposed change, and that current accounting practices often fail to provide all the information that is necessary. Progressive mechanization, the author explained "embraces all or a combination of any six different and distinct phases of manufacture," namely; manual handling; primary mechanization of manual work; advanced mechanization of manual work; elimination and combination of operations; integration of processes; and automation of processes. Each combination, it was suggested, must be considered on its individual economic merits, in order to determine the plan which will give the highest return on investment.

An investigation was carried out by the author's company and it was found necessary, in any given instance, first to determine the actual unit cost for the existing method of manufacture, including the true overhead cost. Next, the most economical manual method, making use of the available facilities, was determined, and the true cost of this method was used as a basis for comparison when various plans for mechanization were being assessed. For the purpose in view, it was found to be unsatisfactory to allocate overheads on the basis of direct labour costs, on account of the rapid increase in the capital investment necessary as full mechanization is approached. As might be expected, moreover, maintenance costs for complex, specialized equipment also tend to assume increasing importance. It was concluded, therefore, that any estimates based solely on direct labour savings are unreliable, and that "return on investment" is the only satisfactory guide. In assessing this return, the effects of mechanization on all elements of cost must be taken into account, and an example was quoted where orthodox methods indicated that the replacement of a manual assembly line by a rotary assembly machine would be justified. When the "return on investment" was accurately determined, however, a negative value of 3 per cent was obtained.

When carrying out a cost analysis, such factors as direct labour, indirect labour, maintenance, consumable tools, scrap, machine depreciation, and floor space were taken into account. Particular attention was paid to maintenance and machine down-time, and such studies sometimes drew attention to the need for improvements in the design of certain parts of equipment. Other valuable incidental information was obtained, and it was found, for example, that for the particular requirements of the factory in question, in-line designs were generally preferable to rotary equipment. It was also noted, in some instances, that hopper feeding arrangements resulted in unduly numerous interruptions, so that it might be more economical to revert to manual loading.

As a result of the investigation, it has proved possible accurately to forecast the savings that can be expected from a change of method, and reliable information is also provided concerning the unit cost constituents, which may be of value for the future. For example, an in-line assembly machine for sparking-plug shells was installed and enabled very satisfactory economies to be made. Analysis of the final unit cost, however, indicated, quite naturally, that overheads and machine depreciation accounted for a much higher proportion of the total than formerly. Consequently, in seeking further cost reductions in the future it will be necessary to pay particular attention to these aspects. To ensure that machine depreciation charges are kept to a minimum, more thought must be devoted to economical design and con-

(*Continued on page* 111)

The Production of Calculating and Ticket-issuing Machines

Methods and Equipment Developed for the Batch Manufacture of a Wide Variety of Precision Components by the Bell Punch Co., Ltd., Uxbridge

Earlier articles in this series* were concerned with the methods and equipment which have been developed by the Bell Punch Co., Ltd., The Island, Uxbridge, Middlesex, for the production of an extensive range of components for calculating and ticket-issuing machines, totalisator equipment, taximeters, and aircraft instruments. It was noted that from 11,000 to 12,000 different types of components are produced in a typical 3-month period, many of which are required in small batches, whereas others must be produced in very large quantities.

The machine shop at the Uxbridge works includes a large battery of single-spindle turret-type and Swiss automatics, and there are well-equipped gear-cutting, milling and grinding sections, as well as the usual drilling, capstan-lathe and other departments. In addition, there is an engraving section, an inspection bay, and a heat-treatment department.

PRODUCTION OF PRESSED COMPONENTS

A large proportion of the components for the company's products takes the form of pressings, and there is a well-equipped press section in the Uxbridge works. The equipment installed includes presses by makers such as Bliss, Schuler, Bentley, and Hordern, Mason & Edwards, and for the production of parts that are required in the largest quantities there are C.V.A. dieing presses of 10 and 50 tons capacity. Wherever possible, the punches and dies are form-ground, in order to ensure the maximum life, and the tools are mounted in pillar die sets. All tools are returned to the tool-maintenance department for checking, regrinding and running repairs, as soon as they have been removed from the presses, so that they are always ready and in good condition for the production of the next batch of components.

A representative selection from the very wide range of pressings that are produced is shown in Fig. 1, and affords some indication of the variety of work that is handled. The two small gears seen at the lower right in the illustration are made from mild steel and are required in very large numbers. Since the profiles of the teeth must be held to close limits, they are finished by shaving, and to ensure concentricity between the teeth and certain holes, the piercing punches for the latter are incorporated in the shaving tool. The name-plate for a Plus adding machine, seen at the lower left, is made from duralumin, and it may be of interest to note that the raised lettering is produced by half-shearing the material. Before this operation, the blanks, which are produced by conventional cropping, are subjected to a straightening operation by passing them through a small bench-mounted roller leveller.

The small spring anchor, seen between the name-plate and the gears, is made from mild steel strip, 0·022 in. thick (24 s.w.g.), in the multi-stage progression tool shown in Fig. 2. A drawing of the part, and a diagrammatic layout of the stages whereby it is produced, are inset. The upper and lower tool assemblies are built up on a Desoutter twin-pillar type, die set, and the upper assembly incorporates a spring-loaded stripper plate *A*. To ensure accurate alignment between the stripper plate (and, consequently, the punches) and the die members, hardened bushes are mounted in the

* MACHINERY, 92/1192–23/5/58 and 92/1492–27/6/58.

plate which engage hardened cone-end pegs that project from the lower tool.

Following normal practice, the strip from which the parts are produced is fed between guide plates *B* in the lower tool, these strips being of stepped cross-section in order to prevent the strip lifting as it is fed from one stage to the next. At the first stage, a rectangular notch is cut in one side of the strip, and the hole is pierced, as indicated at (1) in the strip layout. At the same time, the left-hand half of the form at one end of the part is produced by the punch indicated at *C*, the die aperture for this operation being seen at *D*, in the plan view of the lower tool assembly. The notched strip is advanced through the tool to the next station, where the right-hand half of the lug-form is produced by the same punch that is employed at the first stage, as indicated at (2) in the strip layout. To ensure accurate alignment at the second stage, and succeeding stages, pilot punches are provided, as at *E*, which enter the hole pierced at the first stage. The strip is located crosswise by the engagement of the straight edge of the notch with the guide strip.

No work is performed on the strip at stage 3, but at stage 4 the end of the lug portion is bent downwards by a punch *F*, of square section, over the rounded edge of the die member *G*. The fifth stage of the tool is idle, and at stage 6 the forming of the lug portion is completed. A horizontally-disposed punch is employed for this stage, and is indicated at *H* in the sectional view of the tool. This punch is mounted on a spring-loaded slide *J*, in the lower tool assembly, with one end abutting a dowel pin *K*. The slide is slotted to form a seating for the punch, and the side walls are machined to provide an angular face at the outer end. As the upper tool descends, an angle-cam *L*, secured thereto, acts on the angular face of the slide to thrust it inwards, so that the punch forms the lug of the pressing over the rounded projection on the die member *M*.

The next stage (No. 7) is idle, and as the strip is advanced to stage 8 the workpiece, still attached to it, passes under the spring stripper finger *N*. At stage 8 there is a die aperture of semi-circular form, and a circular-section punch in the upper tool assembly, and these members cut the finished pressing from the strip, as indicated at (8) in the layout. The completed workpieces fall through a hole in the die-set base, and thence into a work-pan. With this tool, spring anchors are produced at a rate of 185 per min.

PRODUCTION OF KEY BAR PRESSINGS

A key-bar for an electric Sumlock calculating machine is shown in the mid-position in Fig. 1. This component is approximately 6⅞ in. long, and is produced from hard, bright mild steel (En. 2) strip, of 18 s.w.g. (0·048 in. thick). Close tolerances are specified for the angles and widths of the slots, and, since there are a minimum of nine on each machine, large quantities are required. Key bars are produced on a C.V.A. 50-ton dieing press, using the multi-stage tool shown in Fig. 3. The parts are made across the 7½-in. width of the strip, and the inter-stage pitch is 0·812 in.

The upper and lower tool assemblies are built on heavy-section bolsters, and are guided by four

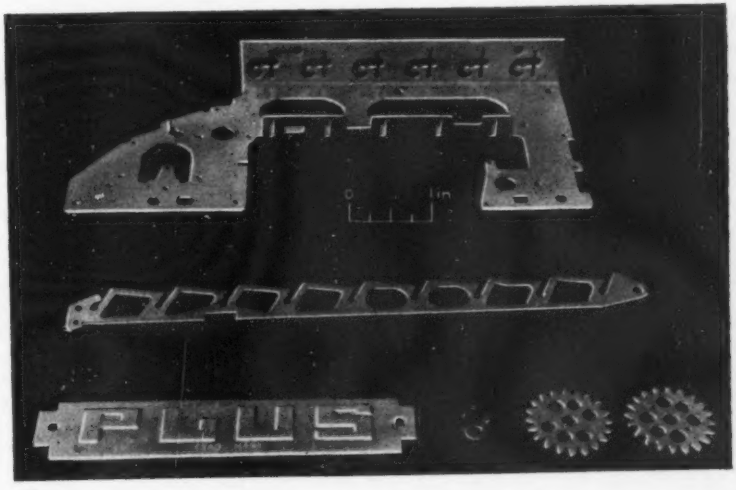


Fig. 1. A Selection from the Wide Range of Pressings made in the Uxbridge Works of the Bell Punch Co., Ltd. At the Top in the Illustration is a Frame Plate for a Calculating Machine, with a Key Bar for a Similar Machine Below. The Bottom Row Comprises a Name Plate, a Spring Anchor and Two Gear Pressings

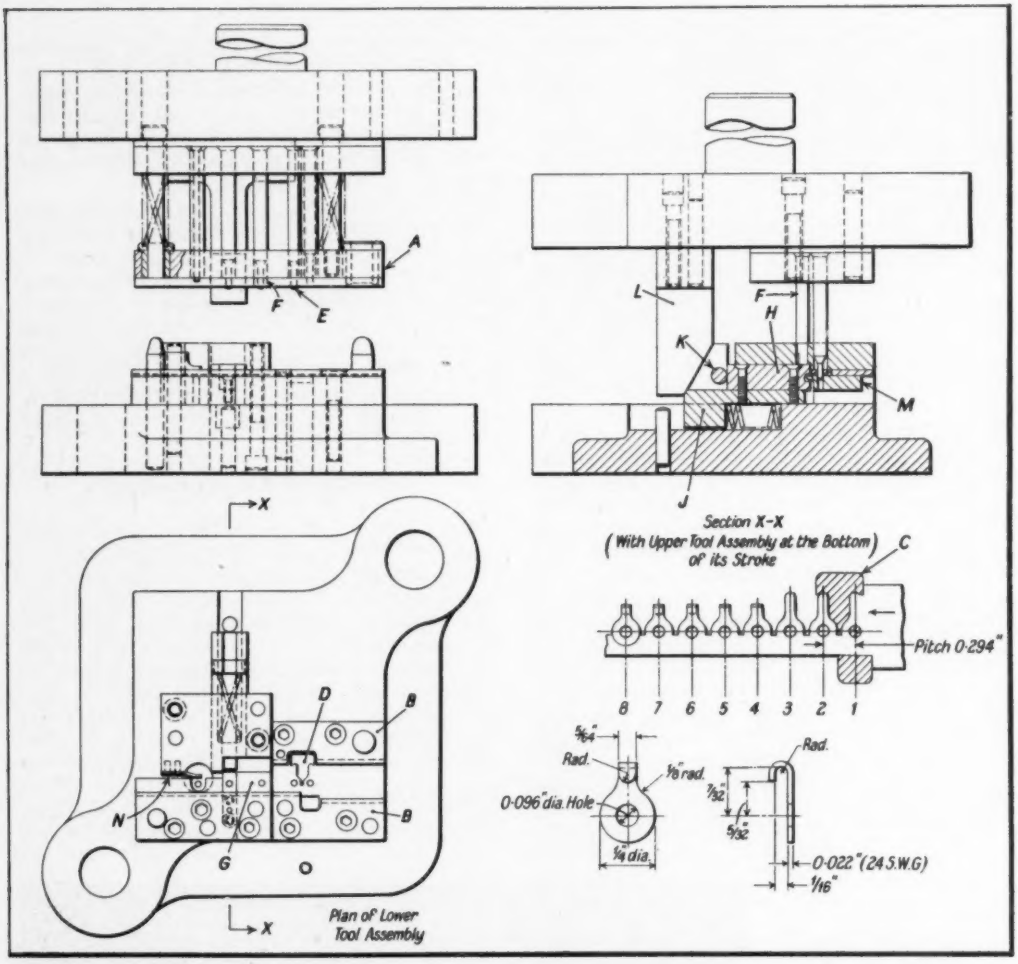


Fig. 2. The Multi-stage Tool for the Production of the Spring Anchor Seen in Fig. 1. A Diagrammatic Layout of the Operation Stages, and a Drawing Giving Details of the Workpiece are Inset

Desoutter pillars and bushes. A spring-loaded stripper plate *P* serves to support and guide the punches, some of which are very slender, and, in its lowest position, the plate is located and steadied by cone-end pegs that project from the lower tool assembly. The latter unit has two strip-guides, of stepped cross-section, one of which incorporates two spring-loaded pressure pads *R*, whereby the work material is thrust against the guide at the opposite side of the tool. This latter guide is slotted to provide for the passage of a notching punch, associated with the die aperture *S*, which produces a cut-out in the side of the strip. The cut-out originally served to locate the strip initially at each tool-stage, in conjunction with two trigger stops *T*. Of these stops, the left-hand unit provided a means of location when the end of the strip of work-material had moved past the right-hand stop, so that two or three more blanks could be produced from a strip of a given length, than would be possible if only one stop were employed. The trigger stops are not required when the tool is used on the dieing press, reliance being placed on the accurate roll-feed mechanism for primary

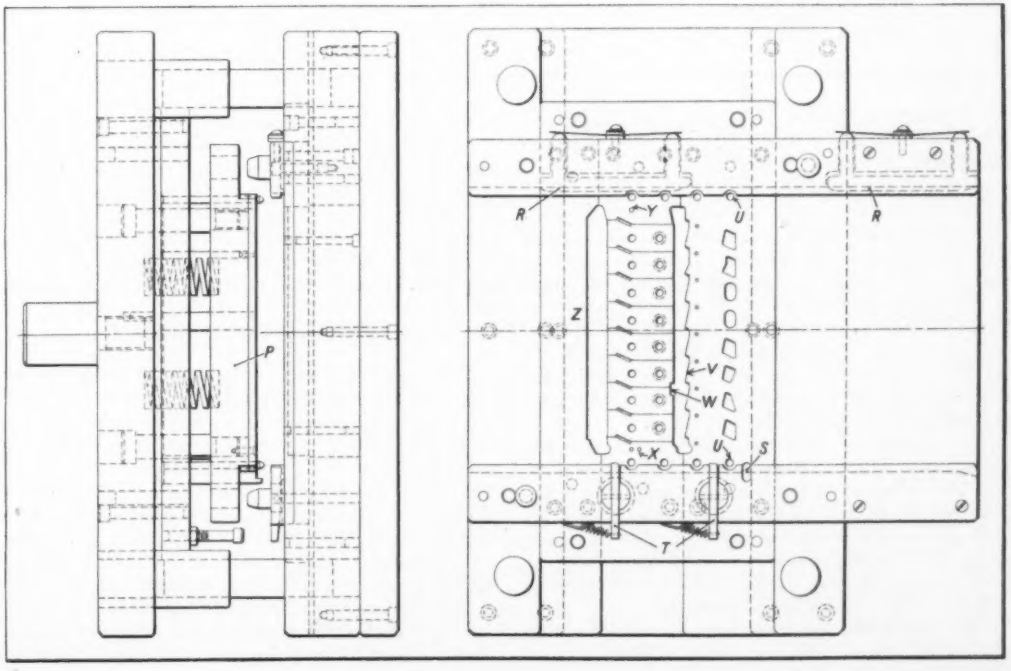
location, and the spigot, seen fitted to the top tool (at the left in the illustration) is also removed.

Details of the workpiece are given in Fig. 4, where a diagrammatic layout of the operation stages is also shown. At the first tool stage, a 0·187-in. diameter, pilot hole is pierced at each side of the strip, and a series of shaped apertures is produced across its width. These apertures, it may be noted, serve to reduce the weight of the finished component. The die openings for the pilot holes are indicated at *U*, in Fig. 3. At the next stage (No. 2 in Fig. 4) nine holes, of 0·077 in. diameter, are pierced across the strip, these holes subsequently forming the ends of narrow slots in the part. Simultaneously with this piercing operation, a long punch cuts a profiled slot across the strip, one side of this slot forming the "saw tooth" edge of the workpiece. To facilitate tool production, the die assembly is of built-up construction, and the cutting edge *V*, Fig. 3, for the "saw tooth" form, is machined and profile ground in the left-hand side of the right-hand die element, which includes the apertures for the other piercing operations that have been mentioned.

On the side of the long form punch, opposite to the "saw tooth" profile, there is a projection which, in conjunction with the slot *W* in the die, produces a rectangular notch in the straight side of the workpiece, when the strip has been advanced to the next stage. Here, as at the preceding stage, the strip is finally positioned by means of pilot pins in the upper tool, which enter the holes pierced at the sides of the strip at the first stage. It will be observed that the die on the left-hand side of the long punch is composed of a series of small inserts, which are screwed and dowelled, also keyed, to the lower tool bolster. The right-hand sides of the inserts are finished flush—except for the notch *W*—to form a single cutting edge. The form of the end inserts is such that the workpiece remains attached to the strip, and additional metal is left on the workpiece for subsequent finishing of the profile at its extremities.

The shape of the inserts can readily be seen in Fig. 3, and this method of construction has been adopted to facilitate the machining and grinding

Fig. 3. This Multi-stage Tool, of Built-up Construction, is Employed for the Production of the Key Bar, seen in Fig. 1. The Width of Strip Used is 7½ in., and the Progression from Stage to Stage is 0·812 in.



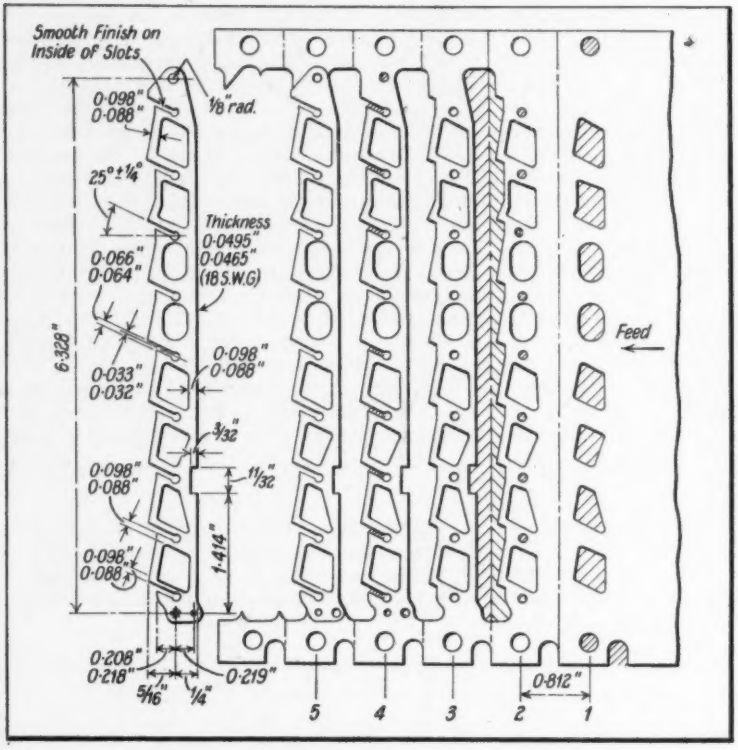


Fig. 4. Details of the Key Bar are Here Shown, with a Diagrammatic Layout of the Various Operation Stages Whereby it is Produced. To Facilitate Tool-making, the Die is of Built-up Construction, and to Maintain the Close Limits that are Specified, the Narrow Slots are Shaved Subsequently

of the die apertures, whereby the angularly-disposed slots are produced in the workpiece at the fourth tool-stage. Each insert is form ground, and has an angular groove at either side. When the inserts are assembled in the tool, the grooves on adjacent inserts mate together to form narrow, rectangular die apertures, at the required angle to the axis of the strip, and it will be appreciated that these apertures would be very difficult to produce satisfactorily in a solid die block. It is important that the slots produced at this stage should be held to close limits for accuracy and finish, and they are shaved at a later operation in the production sequence.

In addition to the slots, which break into the "saw tooth" form at one end and into the pierced circular holes at the other, two small holes are pierced at one side of the strip (die apertures *X*), and one hole is pierced at the other side (die aperture *Y*). The single hole is of 0·1135 in. diameter, and the two holes at the opposite side of the strip are of 0·060 and 0·069 in. diameter.

The workpiece has now been completed, apart from the form at each end, but is still attached to the strip at its extremities. At the next stage (No. 5), there is an elongated blanking punch which produces the end profiles, and severs the workpiece from the strip. The mating die apertures are formed in the long insert Z, and in the large end units of the row of inserts that form the slot dies. With the tool that has been described, key bars are generally produced at an output rate of 80 per min.

MAKING FRAME PLATE PRESSINGS

The large pressing at the top of the group in Fig. 1 is a frame plate for a Plus adding machine. This pressing is made from half-hard mild steel strip, 6⅝ in. wide by 20 s.w.g. (0·036 in. thick), and, because of its complex shape, a series of operations on different presses is necessary. The first series of operations, which includes the production of the flat blank and the piercing of most of the holes, is carried out on the C.V.A. 50-ton dieing press, and plan and sectional views of the lower tool assembly for a similar plate are given in Fig. 5. Details of this latter plate are shown in Fig. 6, and it will be observed that it has five

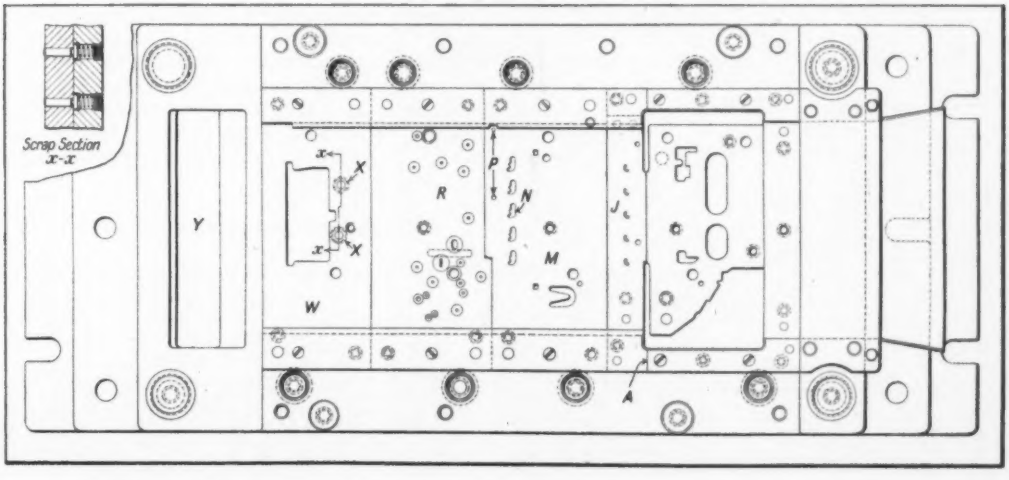
sets of J-shaped apertures and associated transverse slots, whereas the part in Fig. 1 has six. A diagrammatic layout of the operations performed on the dieing press for the production of the second plate is also given in Fig. 6.

Designed by Bell Punch Co., and made by Universal Tools, Ltd., Tramway Path, Mitcham, Surrey, the tool is of built-up construction, to facilitate manufacture, and the various elements are mounted in a 4-pillar die set. The strip is guided by L-section members at each side of the tool, and one guide member carries an index line *A* for positioning the end of the strip when a new length of work-material is inserted. At the first stage, there are two cropping punches which produce the plain and profiled ends of the pressing, as indicated at *B* and *C* in Fig. 6. At the same time, piercing punches produce the two large oval apertures *D*, two openings *E* and *F*, of irregular shape, which eventually form part of the large cut-out in the workpiece, and two pilot holes *G*.

The strip is advanced for a distance of 3·655 in. at each stroke of the press, and at the next stage (No. 2), another series of piercing operations is performed. Two holes, of 0·135 in. diameter, and five crescent-shaped slots (*H*, Fig. 6) are produced at one end of the workpiece, and the die apertures for these openings are cut in the tool element *J*, Fig. 5. The slots *H* form parts of a series of complex openings in the narrow end of the pressing, which is subsequently bent downwards to provide a flange, as may be seen in the drawing of the finished workpiece. An aperture of U-shape is also produced at this stage, as indicated at *K* in Fig. 6, and serves to remove metal to leave a tapering lug, which is later bent to form an L-shaped integral bracket. In addition, two rectangular openings *L*, Fig. 6, measuring 0·162 ±0·001 in. long by 0·125 in. wide, are pierced at this stage. The die apertures for these openings, also that for the U-shaped slot, are cut in the tool element *M*, Fig. 5, and this insert also contains five apertures *N* and two circular apertures *P*, which are required for the next stage (No. 3).

At the third stage, the apertures *N*, and the associated punches, produce openings which blend with the crescent-shaped slots *H* (pierced at stage 2). At a later stage, on another press, a transverse straight slot is pierced across each of the openings thus produced, to receive the stem of the adding machine key, when the latter is finally assembled. A circular pip, which projects into each crescent-shaped opening, serves as an anchor for the key return spring. Most of the small, circular holes required in the workpiece are pierced at this stage, two of these holes being produced by the die apertures *P* and the corresponding punches. Individual die inserts are provided for the remainder of the holes pierced at this stage, and are housed in the tool element *R*. Fig. 5. One hole, indicated at *S* in the strip-layout, Fig. 6, is pierced 0·050 diameter. The position of this hole is such that half of it lies in a lug (seen at *T* in the part drawing, Fig. 6). This lug is sheared and bent at a later stage, on another press, and serves as a lever stop and spring anchor. In addition to the

Fig. 5. Plan and Sectional Views of the Lower Assembly of the Multi-stage Tool for the First Series of Operations on Frame Plates, One of which is Shown at the Top in Fig. 1



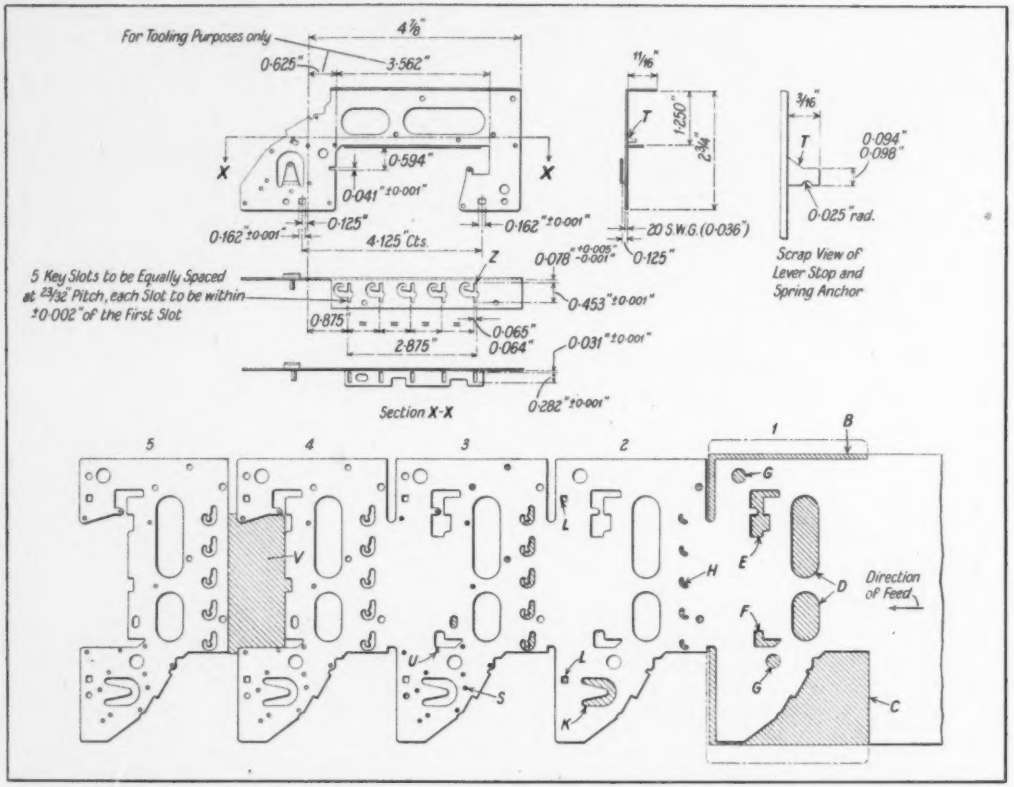


Fig. 6. Details of the Frame Plate for a Plus Adding Machine, and a Diagrammatic Layout of the First Series of Pressing Operations, are Here Shown

punches and die inserts for the circular holes, there is a pair for piercing a slot, 0·041 ±0·001 in. wide, seen at *U* in the strip layout. This slot breaks into the aperture *F*, pierced at the first stage. It may also be noted that, at the third stage, no hole is produced in the tapering lug (in the aperture *K*). This hole is pierced separately, after the lug has been bent to its final L-shape.

After the workpiece has been advanced to the next stage (No. 4), the large opening in the leading edge is cropped out, as indicated at *V* in the strip layout. The die aperture for this operation is cut in the tool element *W*, Fig. 5, which incorporates two spring-loaded plungers *X*, the latter also being seen in the sectional view. The cropping punch and die serve, in addition, to cut the workpiece from the strip when it has been advanced to the fifth stage of the tool, and the spring plungers *X* lift the strip slightly to prevent the metal at the corners of the opening *V* from engaging the edge of the die opening, as the strip is transferred, and thus impeding movement. When it has been cut from the strip, the pressing falls through a large rectangular opening *Y* in the tool, and thence into the discharge chute of the press. With the tool described, frame plate blanks are produced at a rate of 130 per min.

PIERCING SLOTS IN FRAME PLATES

As has already been intimated, the pressings produced on the C.V.A. dieing press require certain subsidiary operations before they are complete. From stage 5 of the strip layout (Fig. 6) it may be noted that two sets of five slots, in the area that eventually forms the flanges of the workpiece, are not pierced on the C.V.A. machine. These slots, of 0·064/0·065 in. width, are positioned relative to the inside face of the flanged component, and, for

this reason, they are pierced after the flanges have been formed.

Frame plates are made in a range of sizes, but the methods employed for their production are generally similar. In Fig. 7 is shown the set-up, on a Hordern, Mason & Edwards type L.20 press, for piercing the slots in one of the larger frame plates, used on a Sumlock machine. One of these plates may be seen at the front of the press platten, after the slot-piercing operation has been performed. Slots are pierced in two stages, and the set-up in Fig. 7 provides for piercing the slots that intersect the J-shaped apertures in the wider flange of the workpiece. The tool has a set of horizontally-disposed, spring-loaded punches, which are thrust towards the front of the press, for cutting, by a wide wedge cam, secured to the upper member of the die set, at the rear. Associated die apertures are cut in a plate which is screwed and dowelled to a support block in the lower tool assembly, and this block is slotted to provide for slug disposal.

A frame-plate is loaded with the flanges downwards and the profiled end to the right, and embraces the block that carries the die plate for the longer slots *Z*, Fig. 6. The narrower flange passes between this block and a block at the front of the tool. For location purposes, the large cut-out in the pressing, indicated at *V* in the strip layout, Fig. 6, is held to close limits for both width and position, at the blank-production stage. A plate on the block at the front of the tool extends upwards, and the length of the plate is such that it engages the sides of the cut-out when the pressing is loaded, to locate it lengthwise.

It is important that the underside of the main body of the pressing should be in contact with the other die block, and special interlocking arrangements have been incorporated in the tool and press, so that the latter cannot be operated if the workpiece has not been correctly seated—due, for example, to the presence of a slug between the mating surfaces. The normal clutch-operating pedal of the press has been disconnected, and a solenoid-actuated clutch-operating mechanism has been fitted in its place, as indicated at *A*, in Fig. 7. This solenoid unit is connected by cable to a shrouded pedal-switch *B*, which is in series with Burgess micro-switches *C* and *D*, at either side of the tool. To facilitate mounting and removal of the tool, the switches are wired to a socket at the centre of the tool set base, and the cable from the pedal-switch is coupled to this socket by means of a Niphan plug *E*.

At each side of the lower tool, there is a box-section guide for a sliding blade, which is withdrawn for loading the workpiece, as seen at *F*. When the blade is withdrawn, the switch contacts are opened, and the pedal-switch is inoperative. The lower faces of both blades can just clear the workpiece when it is correctly seated, and, after loading, both blades are moved inwards. If the blades can be advanced until they assume the position of that indicated at *G*, a lug on the side of each blade depresses the operating plunger of

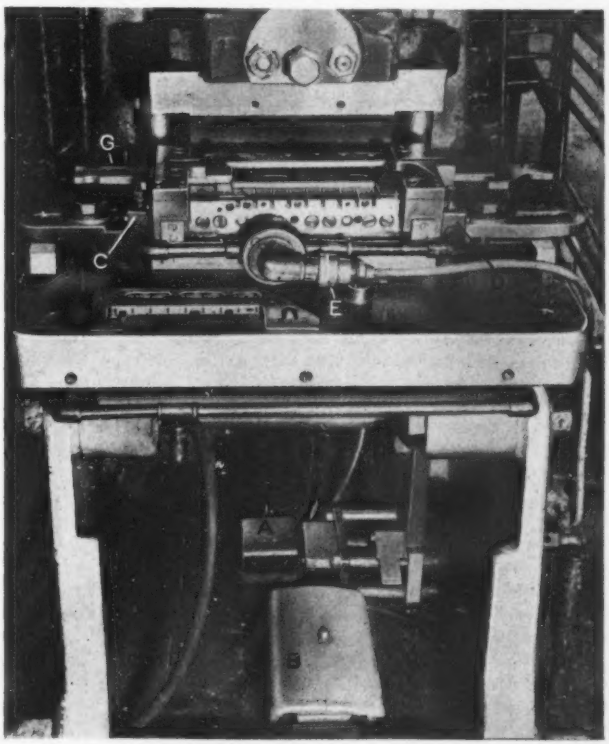


Fig. 7. The Set-up for Piercing Slots for Key Stems in Frame Plates for Sumlock Calculating Machines. Sliding Blades are Fitted at Either Side of the Tool, and Unless the Workpiece has been Loaded Correctly, these Blades cannot be Moved Inwards, and the Press Cannot be Operated

the micro-switch, and the contacts are closed. Both blades must be advanced, and their micro-switches tripped, before the circuit to the pedal-switch is completed, and the clutch of the press can be engaged.

SHAVING GEAR PRESSINGS

The gear pressings seen at the lower right in Fig. 1 are for a Sumlock calculator, and are typical of components that are produced in large quantities by the Bell Punch Co., Ltd. On the gears shown, there are 20 teeth, which are of 20 D.P., involute form, with a special pressure angle of 25 deg. Since the flanks of the teeth must have a high-quality finish, in order to ensure smooth operation and reduce friction to a minimum, the gears are produced in two stages. At the first stage, hard, bright mild steel strip of 20 s.w.g. (0·036 in. thick) is pierced and blanked on a roll-feed press to produce semi-finished pressings, one of which is seen at the left of the pair in Fig. 1. These pressings are then shaved and pierced, to provide the finished gears, as seen at the right.

Fig. 8 shows the compound tool for the first stage. A fixed blanking punch *H* is mounted on the heavy base member of a Desoutter die set. The cross-section of the punch corresponds to the profile of the finished gear, but is 0·003/0·004 in. larger all round the form, in order to provide excess metal for the shaving operation. A stripper plate *J* is arranged to slide on the punch, and is urged upwards by four threaded pins *K*, which engage the upper member of a spring buffer below the die-set base. The stripper plate carries six shoulder screws *L*, with large heads, which are positioned in pairs, four on one side of the punch and two on the other side, and serve to guide the 1¼-in. wide strip. There are seven circular die apertures in the punch, one of which is for the 0·156/0·157-in. diameter central hole in the work-piece, five are for $\frac{5}{32}$-in. diameter lightening holes, and one is for a lightening hole of $\frac{11}{64}$ in. diameter. The latter hole is made slightly larger than the other five for tooling purposes. A plunger-type stop *M* is also mounted on the stripper plate for locating the end of the strip initially.

The piercing punches for the lightening and other holes are fitted in the upper tool assembly, as indicated at *N*, and pass through holes in the pressure pad *P*. This member is a sliding fit in the blanking die *R*, and is urged downwards by powerful springs. As the upper tool assembly moves downwards at each press cycle, the strip of work-material is gripped between the pressure pad *P* and the fixed punch *H*, and is supported by the stripper plate *J*. As movement continues, the pressure pad springs are compressed and the die passes over the punch *H*, to cut the blank from the strip, which is thrust downwards, with the stripper plate, by the die, against the pressure of the spring buffer. At the same time, the piercing

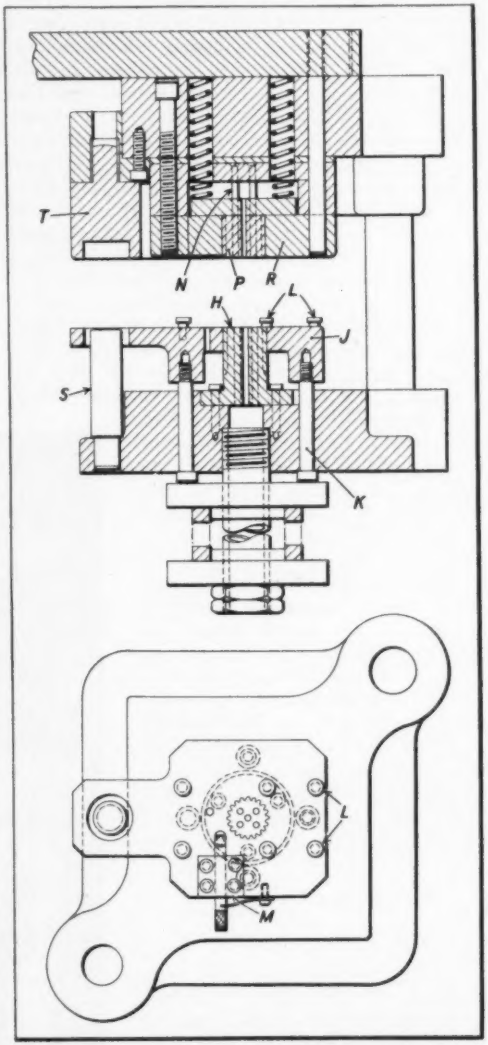


Fig. 8. Gear Blanks, seen at the Right in the Lower Row, Fig. 1, are Produced by Means of this Compound Tool. There is an Allowance of 0·003/0·004 in. Round the Form, to Provide for Shaving at a Subsequent Operation Stage

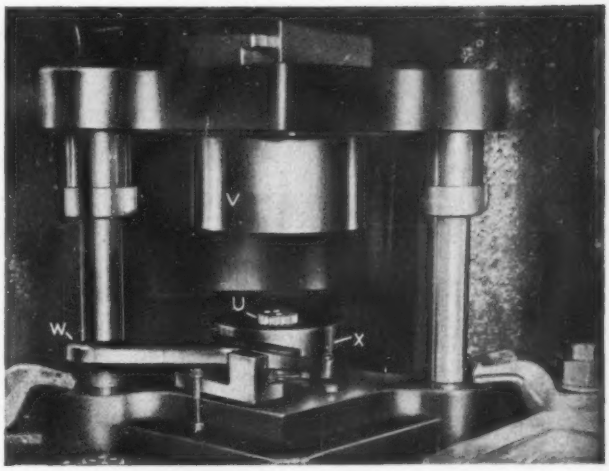


Fig. 9. Close-up View of a Shaving Tool Set-up on a Bentley 30-ton Press for Finishing Gear Pressings. A Stripper Plate Surrounding the Shaving Punch in the Lower Tool is Actuated by the Lever at the Left

punches *N* in the upper tool assembly, in conjunction with the die apertures in the punch *H*, pierce the various circular holes in the workpiece.

When the ram of the press rises, the strip is thrust upwards by the spring-loaded stripper plate *J*, but the workpiece is still held between the punch *H* and the pressure pad *P*. In consequence, the workpiece is re-engaged with the strip. As the strip is advanced in readiness for the next operation cycle, the workpiece is carried with it, and comes to rest over the ejector punch *S*. During the downward movement of the upper tool assembly, the ejector die *T* contacts the strip and thrusts it downwards with the stripper plate *J*. The ejector punch *S* is stationary, however, and presses the workpiece out of the strip. When the upper tool assembly rises, the workpiece is blown clear of the tool area by an air blast.

Referring to the finished gear at the right in Fig. 1, it will be observed that there are two small holes in addition to those produced by the tool that has just been described. Because it is essential that these holes should be positioned accurately relative to the finished gear teeth, they are pierced by punches which are incorporated in the shaving tool. In many respects, the shaving tool resembles the blanking tool for the first stage, and has a fixed punch, mounted on the base member of a Desoutter die set. The upper tool assembly incorporates a shaving die, fixed to the top member of the die set, a spring-loaded pressure pad that slides in the die aperture, and two piercing punches that slide through holes in the pressure pad, and operate in conjunction with apertures in the shaving punch.

In Fig. 9 is shown a set-up for shaving a gear pressing of the same general form as that considered above, but with a somewhat different hole arrangement. Apart from the location of the piercing punches, the shaving tools for both gears are similar in design. The shaving tool is shown mounted in a Bentley, type G.11, 30-ton press, which is fitted with an automatic guard, so that the clutch cannot be engaged unless the guard is closed. A gear pressing is dipped in a shallow tray of paraffin, at one side of the press platten, and is placed on top of the shaving punch *U*, where it is engaged with three pegs. One peg is slightly larger than the others, and enters the oversize tooling hole, to locate the workpiece angularly, with its teeth aligned with those of the punch. Then, the guard is closed and the clutch pedal is depressed. As the upper tool descends, the pressing is gripped between the shaving punch and the pressure pad in the upper tool assembly, before the shaving die *V* removes a thin sliver of metal from all round the form. During the shaving cut, the punches in the upper tool assembly pierce the two holes that must be concentric with the teeth.

When the upper tool rises, the pressure pad prevents the shaved workpiece from being carried upwards with the die, and it remains on top of the shaving punch. Before the next workpiece is loaded, the operator depresses the lever *W* and thus raises the stripper plate *X*, lifting the shaved gear and the scrap material. The gear and scrap are then blown clear of the tool by an air blast. With the tool that has been described, gear pressings are shaved at a rate of 480 per hour, and the number of parts that can be shaved between successive tool regrinding operations is about 65,000. After shaving, gears are subjected to a tumbling operation, for a period of about 10 min., to remove any small burrs.

MAKING KEY STEMS

Key-tops for the firm's Plus and Sumlock adding and calculating machines are moulded from coloured plastics material, with plastics inserts of a contrasting colour, which form the large and

Fig. 10. A Key for an Electric Calculating Machine is Shown at the Lower Left, with the Associated Key Stem at the Right. Above, are Seen a Group of Key Stems for Manually-operated Machines

small identifying numbers, or other signs. The key-top is mounted on one end of a part known as a key stem, and a typical key assembly for an electric machine is shown at the lower left in Fig. 10, with the corresponding key stem at the lower right. Key stems of this type are produced by a sequence of pressing operations from hard, bright mild steel strip, which is 0·060/0·062 in. thick. Although these components are produced at high output rates, cut strip material is employed, in preference to coiled stock, since it has not been found possible to obtain material in the latter form which is consistently within the 0·002 in. thickness tolerance required.

Details of a 4-stage tool for making key stems are given in Fig. 11, and it may be noted that it has a solid stripper plate. Strip, 2½ in. wide, is fed from right to left, and is thrust by the spring-loaded shoe *A* against the guide member at the opposite side of the tool. The end of the strip is positioned initially by the trigger stop *B*, and, at the first tool stage, a notch is cut in one edge by the punch *C* and its associated die aperture *D*. At the same time, a round-end slot is cut in the strip by a punch in the upper tool assembly and the die aperture *E*, and a 0·088-in. diameter hole is pierced by a punch and the aperture in the die insert *F*. The notch, slot and hole are seen shaded in stage (1) of the strip layout in Fig. 12, where details of the key stem are also given. From the strip layout, it will be observed that two pilot holes *G* are pierced at the first stage, and the dies for these holes take the form of bush inserts, as indicated at *H*, in Fig. 11.

With these operations completed, the strip is advanced through a distance of 0·750 in., after the upper tool assembly has been withdrawn, and then is located initially by the right-hand edge of the notch produced at the first stage, which engages the trigger stop. The strip is finally positioned by pilot punches in the upper tool assembly, which enter the holes *G*, Fig. 12, as the press ram descends. It will be noted that the die assembly of the press tool is of built-up construction, in order to facilitate machining and grinding the larger die apertures. The edge *J*, Fig. 11, of the right-hand die element, forms part of the right-hand die aperture of the second stage. There are two apertures and piercing punches at this stage, which produce the dog-leg form of the stem and the lug at one side, as indicated at (2) in the strip layout, Fig. 12. In addition, a V-groove, of 90 deg. included angle, is staked in the strip, in such a position that it will eventually lie in the small end of the key stem, where is serves to retain the moulded head. This groove is indicated at K in the strip layout, and details of its form are shown in the perspective view (*x*), Fig. 12. The groove is produced by a chisel-ended staking punch in the upper tool assembly, with the strip supported on the flat upper face of the die assembly.

It is required to swage the lug produced at the side of the pressing, at stage 2, to produce the form indicated in the perspective view (*y*), Fig. 12. This operation is carried out on the strip at stage 3, the metal being formed between the punch *L* and the anvil *M*, Fig. 11. The faces of the lug, after it has been swaged, must be flat and smooth, and the end and one side of the lug must be held to close limits, with respect to the side of the stem and the datum point at one extremity of the round-end slot. To maintain these limits, the lug is shaved by the punch and die at the next stage (No. 4), which also carry out two cropping operations on the work-material, to produce the form

of the workpiece at the large and small ends, and to sever it from the strip. The die aperture is indicated at *N* in Fig. 11, and the lug is shaved by the projection *P* and the adjoining side face.

To allow the maximum number of pressings to be produced from each strip, a second trigger stop *R* is fitted to the tool. This stop positions the strip for the remaining stages, after the end has been fed clear of the stop *B*, final location for the last stage being effected by the pilot punch S. By means of this tool, key stems are produced at a rate of 80 per min. Subsequently, the edge-faces at each end of the key stems (as indicated by the dimensions 0·249/0·247 in. and 0·466/0·463 in. in Fig. 12) are shaved to ensure a smooth finish.

COMPOUND TOOL FOR KEY STEMS

The key stems in the upper row in Fig. 10 are for manually-operated Sumlock Figureflow machines, and eight different variants of a basic design are required. At one time, it was the company's practice to produce a common blank on a power press, and, then, to carry out a series of secondary operations whereby the blank was modified to the form of the particular key stem that was required. These operations included shaving, piercing a circular hole, cropping the forked end, cropping the tongue, machining a nick in one side, countersinking, and, on certain stems, piercing lightening holes. This procedure has now been superseded by a new method whereby each stem is blanked, pierced and staked, using a compound tool, the only secondary operations that are required being shaving, and countersinking.

The compound tool for producing the No. 9 key stem, seen at the right in Fig. 10, is shown in Fig. 13, and was designed and made by Technidraft (Hayes), Ltd., 3 David Road, Poyle Estate, Colnbrook, Bucks. This tool, and similar tools for other stems, are used on a Bliss No. 21 B press, equipped with a double roll-feed mechanism, and pneumatic balancing arrangements for the ram, the No. 9 key stems being produced at the rate of 63 per min. Strip material is again employed, due to the close limits on thickness, and is 0·062-in. thick by 3-in. wide mild steel.

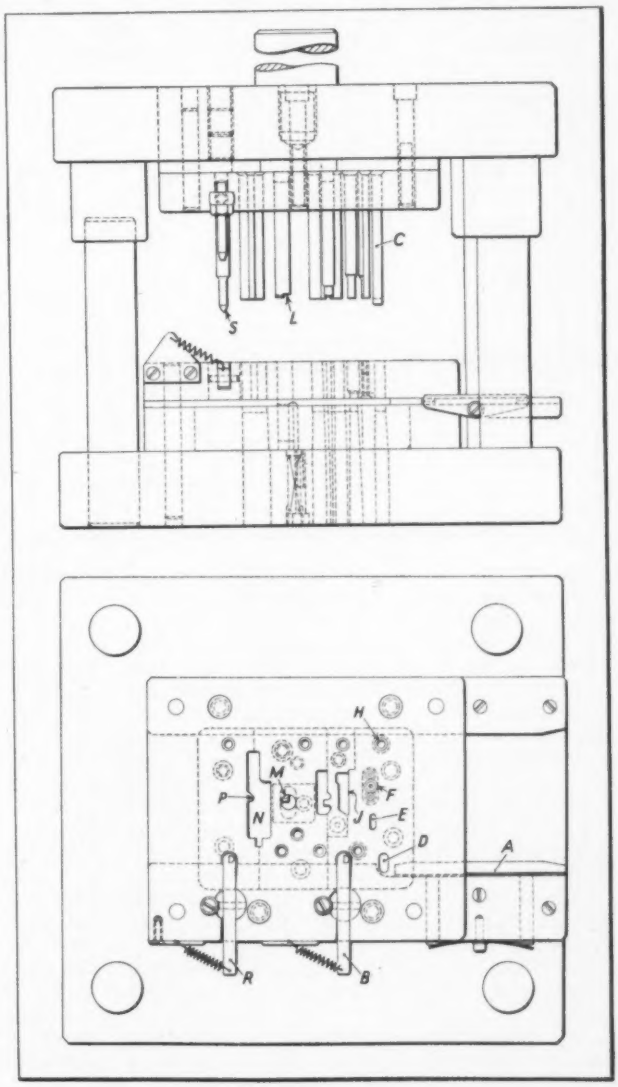


Fig. 11. This Multi-stage Tool is Employed for the Production of Key Stems for Electric Calculating Machines. For Clarity, One Trigger Stop Assembly is not Shown in the Upper View

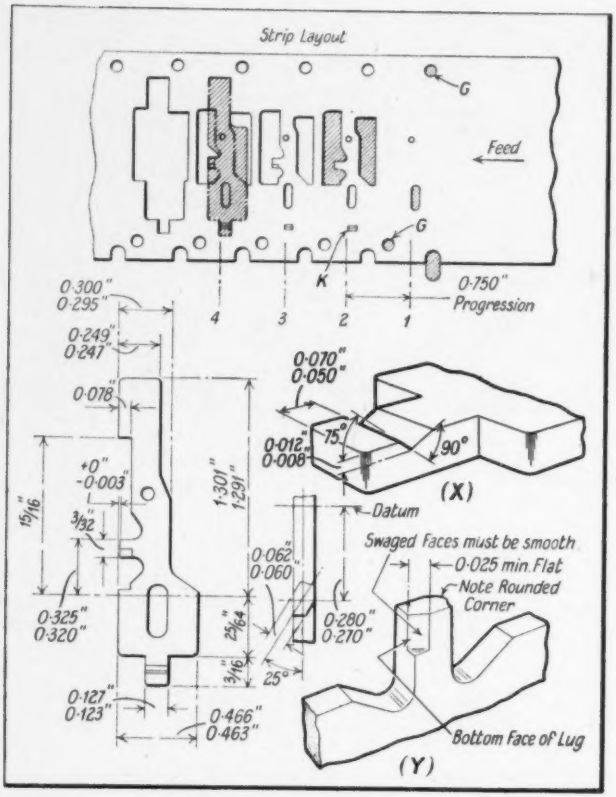


Fig. 12. Details of the Key Stem for an Electric Calculating Machine are Here Shown, with a Diagrammatic Layout of the Operation Stages Whereby it is Produced

As may be observed, the blanking punch is of built-up construction, to facilitate tool making, and is mounted on the base member of a heavy, twin-pillar die set. Both the top and bottom members of the die set are made of cast iron, and the steel pillars, which are hardened and ground, slide in fine-bored holes in the top member. Criss-cross grooves are cut in the upper end of each pillar to transmit lubricating oil. The punch element *A* has die apertures for the two elongated lightening holes, also a hole that is later countersunk, and the element *B* embodies the aperture for the hole in which a spring anchor pin is subsequently fitted. A circular stripper plate *C* surrounds the blanking punch assembly, and is urged upwards by four powerful square-section springs. The staking punch *D* also forms part of the lower tool assembly, and passes through a suitable rectangular aperture in the stripper plate, when the latter is in the depressed position.

The blanking die is indicated at *E* in the upper tool, and surrounds a pressure pad *F*, the shape of which corresponds to that of the blanking punches. For ease of machining and grinding, the die is made in two halves, which are secured to the retaining plate *L*, by screws and dowels. Piercing punches *H*, for the elongated holes, are secured to the backing plate *G*, but the punches *J* and *K*, for the circular holes, are headed, and are held against the backing plate by the retaining plate *L*. All the piercing punches slide in apertures in the pressure pad *F*. The latter member slides in the aperture of the blanking die, and is urged downwards by pins, as at *M*, to which thrust is applied by a powerful spring, through the disc *N*. A vertical rod rests on the top of the disc and serves to connect it to the horizontal knockout bar of the press, when the ram reaches the top of its stroke.

When the upper tool assembly is moved downwards, the work-material is gripped between the pressure pad *F* and the blanking punch assembly, and is supported by the stripper plate *C*. As movement continues, the blanking and piercing punches in the upper tool assembly make contact with the work-material and force it downwards, depressing the stripper plate, and causing the punches to cut the external profile and holes of the workpiece. The pressure pad *F*, holds the blanked workpiece firmly against the blanking punch, due to the pressure exerted by the powerful spring in the upper tool, and thus prevents distortion. At the same time, the staking punch *D* produces a group of V-section depressions in the strip, in a position from which the small tongued end of the following component will be cut during the next press cycle. This staking punch, it may be of interest to note, was originally of a simple chisel form. On account of the out-of-balance loading, however, the life of punches of this form was relatively short. A punch of modified design is now incorporated which has a central chisel edge, which is slightly

wider than the width of the tongue on the workpiece. There are narrower chisel edges on either side, the sloping faces of which are inclined in the opposite direction to that of the central edge. The side thrust of the two smaller edges balances that of the central edge, so that no transverse strain is imposed on the punch, and its life has been considerably extended. The two smaller indentations are produced in waste areas of the strip.

If the workpiece should stick in the upper tool during the return stroke of the press, it is ejected by the action of the knock-out bar on the disc *N* and the pressure pad *F*. Workpieces and slugs from the piercing operations are blown clear of the tool by an air blast, and the press is inclined to facilitate the discharge of both work and slugs. The jets for the compressed air can clearly be seen in Fig. 14, which is a general view of the tool area of the Bliss press. The strip passes from right to left, as viewed in Fig. 14, and is guided by angle-section members, which are mounted on supports at either side of the tool. These members are adjustable crosswise, to cater for strips of different widths. Two sets of guides are provided to allow the last few inches of each length of strip to be used.

Since the press tool required many hours of toolmaking and, therefore, is expensive, special precautions have been taken to prevent the formation of half-blanks, which might enter the tool apertures, and cause jamming and damage. The support for the guides at the right-hand side of the tool incorporates a hinged platen *P*, which is lightly spring-loaded upwards. Beneath this platen there is a microswitch which is connected to the push-button stations at the front of the press. There are two stations, and at each there are two buttons, one for continuous running and the other for single-stroke operation. Corresponding buttons at both stations must be depressed before the press can operate, to ensure that the worker tending the press has both hands clear of the working zone.

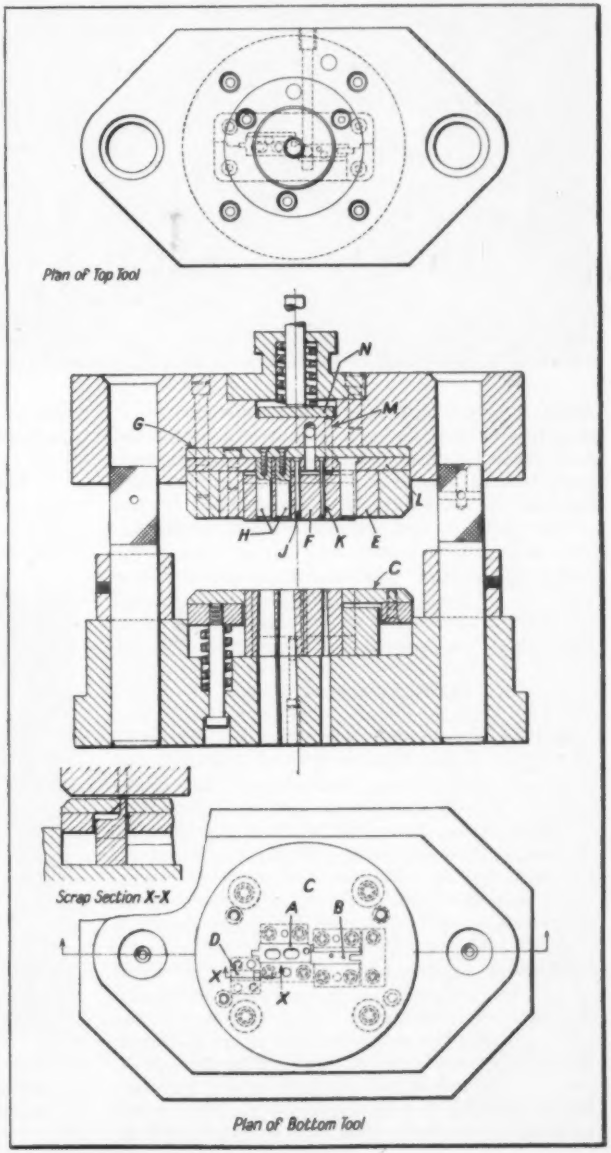


Fig. 13. This Compound Tool is Employed to Produce Key Stems for Sumlock Figureflow Machines at an Output Rate of 63 per min. Since Close Tolerances are Specified for Thickness, Strip Material is Used

K

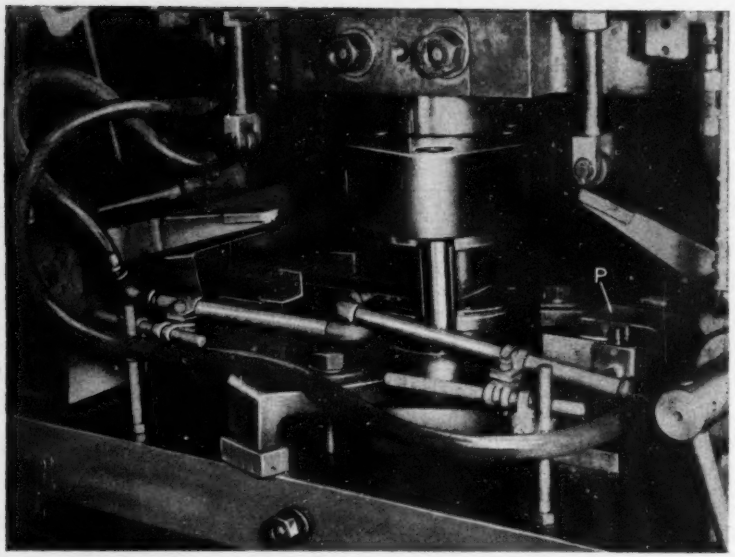


Fig. 14. Close-up View of the Compound Tool, Fig. 13, Set up on a Bliss No. 21 B Press, Equipped with a Double Roll-feed Mechanism, and Pneumatic Counterbalance for the Ram

When a length of strip is fed into the press tool, it depresses the platen *P* so that the associated limit switch is closed. Then, once the appropriate push buttons have been depressed, the press runs continuously until the end of the strip moves clear of the platen *P*, and the micro-switch is released. The length of strip extending to the right of the tool at this stage is sufficient for the production of some six or seven blanks, and these are produced with the press running under single-stroke operation, under the control of the operator.

FLATNESS-CHECKING GAUGE

Key stems must slide freely, but without excessive play, in the slots in the frame plates, the piercing of which was discussed earlier in this article. It is for this reason that close limits are specified on the thickness of the material, and the flatness of the components, after they have been produced by the pressing operations described, must be held within 0·002 in. A flatness check is carried out with the aid of the gauge shown in Fig. 15. This gauge consists of a heavy plate, whereon are mounted two blocks. The inner end of each block is machined to form three anvils, and the faces of these anvils are ground flat, in the same plane, after the block has been hardened. By virtue of their elongated fixing holes, the blocks can be adjusted relative to each other, and they are set parallel, and are separated by a gap which exceeds the thickness of the key stem by 0·002 in. Each key stem is checked by inserting one end into the gap, at the upper end of the gauge, and allowing it to fall downwards between the anvils. If the straightness of the stem is within the prescribed limits, it passes between the three pairs of anvils. Should it be bent, however, it is trapped in the gauge, as shown, and is removed, straightened by planishing in an adjacent press, and re-checked.

PRE-HEATING OVEN FOR PLASTICS MATERIALS

Many of the components for the company's products are made by blanking and piercing operations

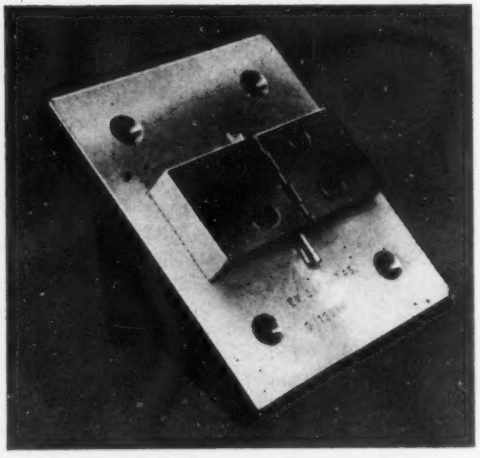


Fig. 15. This Gauge is Used for Checking the Flatness of Key Stems, which must Fall, Under the Influence of Gravity, between the Anvils on the Two Blocks

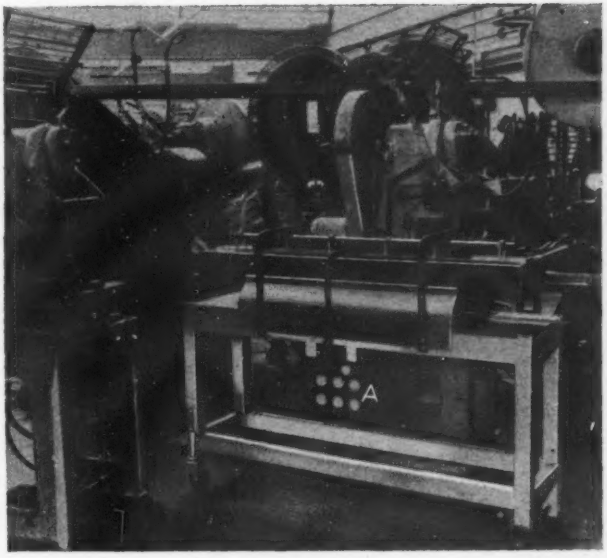


Fig. 16. To Prevent Fracture during Blanking, and to Reduce Tool Loads, Plastics Materials are Pre-heated in this Infra-red Oven Built by the Company, Before Pressing Operations are Performed

from plastics strip, the materials that are worked including Bakelite, Perspex, and other plastics of the thermo-setting and thermo-plastic types. In order to prevent fracture of these materials when they are blanked, and to reduce the working loads on the presses and tools, the plastics strips are pre-heated, before they are fed into the tools, by means of the portable oven shown in Fig. 16, which has been built by the company.

The equipment has a wooden trolley base, with a sheet-steel top, above which a Metropolitan-Vickers infra-red heating unit is supported on a tubular framework. Shrouds are fitted at each side of the equipment to reduce heat losses by convection from the work-material, and the heating elements are arranged in two parallel rows of three, to facilitate control. Each element is controlled by a Simmerstat unit in the control cabinet A, so that, if necessary, the outer elements can be set to provide a slightly higher temperature, in order to offset cooling effects due to the open ends. A pilot light, above the two rows of Simmerstat control knobs, indicates when the oven is connected to the power supply and the total load of the oven is 1·5 kW.

In Fig. 16, the oven is seen alongside a Wells 3-ton press, set up for producing simple blanks from phenolic sheet. The strips of work-material can be inserted at either end of the oven, and rest on the sheet-steel top of the trolley. The setting of the Simmerstat controls, and the length of time that the strip remains within the oven, are determined by trials, and depend upon the type of material that is being worked, also its thickness. For example, $\frac{1}{16}$-in. thick Bakelite sheet requires the shortest heating period, namely 1½ min., whereas Nylon requires heating for a much longer time. When ¼-in. thick Nylon (the maximum thickness employed) is being worked, the strips are held in the oven for 20 to 25 min. The press operators use gloves for handling the hottest materials, and heating elements are incorporated in the bottom assemblies of the press tools used for particularly difficult jobs. As a further example of the use of this oven, it may be mentioned that it is used for heating ¼-in. thick Bakelite strip before it is pierced and blanked on a Bentley 80-ton press. The blank measures 6 by 4 in. and has a total of 30 pierced holes.

CROSLAND PRESS TOOLS

Certain of the sheet-metal components made by the company are required in relatively small quantities, and for these parts Crosland press tools are employed, since those of the conventional type would not be economical. These tools are made by William Crosland, Ltd., Bredbury, near Stockport, Cheshire, and were described in detail in an article in MACHINERY, 83/347—21/8/53. It suffices here to note that the cutting members of the tools are formed from steel strip, which is mounted in a Hy-du-lignum supporting member. The strip is usually of 16 s.w.g., or heavier, and is as wide as the support is thick. Circular rubber buffers are fitted all round the punch, and within the die aperture, and serve to support and grip the work-material initially, and to strip and eject the blank and waste.

A representative group of workpieces and tools is shown in Fig. 17, and the construction of the tools may readily be observed. The pressing indicated at A is made from 16 s.w.g. mild steel, and measures 3½ in. long by 1⅝ in. wide, the total length of shear being 8 in. Seen above and below the

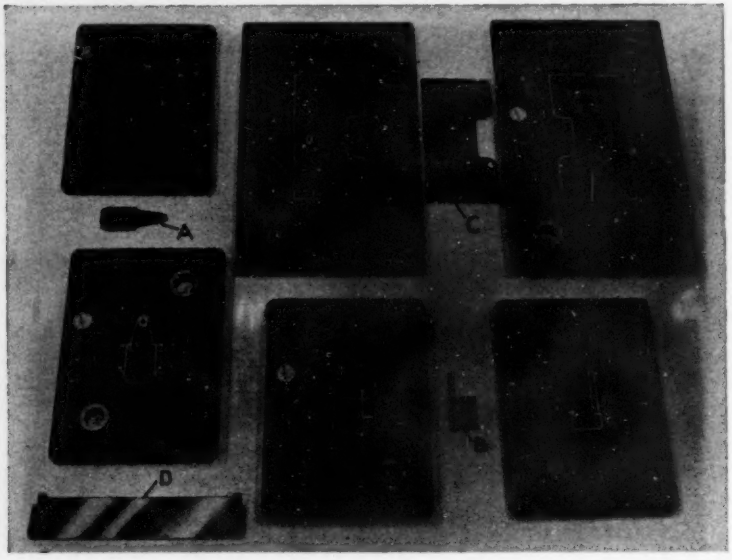


Fig. 17. For Sheet-metal Components that are Required in Small Quantities, the Bell Punch Company Makes Use of Crosland Press Tools, Representative Examples of which are Here Shown

pressing, the Crosland tool is used on a 45-ton press. The part *B* is made from 0·036 in. thick (20 s.w.g.) spring steel (En. 42A), and tool members for producing it are seen at the right and left. This pressing measures 3 by 1¼ in., and has a total shear length of 7½ in., the tool being used on a 30-ton press. A larger pressing in 16 s.w.g. mild steel is seen at *C*, and measures 7 by 3 in., the total shear length, in this example, being 24 in. The Crosland tool for making this piece is used on an 80-ton press. The cost of the tools shown ranges from £25 to £30, and pressings are produced generally in batches of 200. Each tool had been used to make about 4,000 pressings at the time that this article was prepared.

Crosland tools are used by the company for a variety of materials, and, to date, the most difficult job that has been attempted—and performed satisfactorily—was the production of the blank seen at *D*, which is made from 16 s.w.g. (0·064 in. thick), austenitic stainless steel (En. 58B).

The use of these tools is not confined to small pressings, and a blank measuring 28 in. long by 13 in. wide is shown in Fig. 18, with one of the two Crosland tools employed for its production. It may be noted that the lower tool is shown in the vertical position. The end of the workpiece nearest to the camera is blanked out first, from a sheet of 16 s.w.g. mild steel, and a punch and die are incorporated in this tool to produce a round hole, for location of the semi-finished blank in the second tool. This location hole is positioned in an area of the material which is waste, and it is engaged with the peg *E*, Fig. 18. The workpiece is then aligned by two pegs on the outrigger support *F*.

The tools are used on a 130-ton press and the total length of shear on the completed workpiece is 86 in. About 400 workpieces have been produced with the tools so far, in batches of 150 to 200 pieces, and the cost of each tool was approximately £75.

Other examples of the interesting production methods and tooling that have been developed by the Bell Punch Company, Ltd., will be described in further articles in this series, which will be published shortly in MACHINERY.

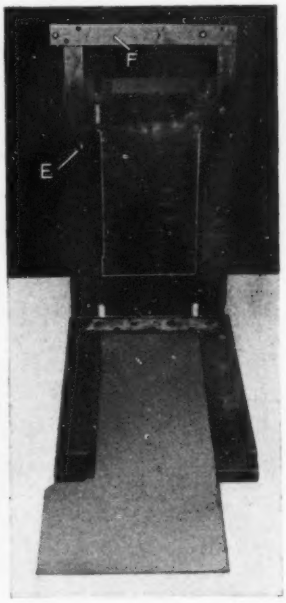


Fig. 18. A Large Blank in 16 s.w.g. Mild Steel is Made in Two Stages by means of Crosland Tools. The Tool for the Second Stage is Here Shown, with a Workpiece

Some Standard and Special Machine Tools Built in the TOS-Kurim Factory, Czechoslovakia

Following the establishment of a planned economy in Czechoslovakia, the machine tool industry of the country was the subject of progressive rationalization with the object of avoiding duplication of effort in the design and building of particular types of machines. As a result of this policy, work in connection with the development and construction of special-purpose and unit-head machine tools is now concentrated at the TOS-Kurim works, in the district of Kurim, near the town of Brno, in Moravia. This factory, it is stated, is the largest and most up-to-date unit in the Czechoslovak machine tool industry, and other products include knee-type and plano milling machines, and horizontal boring machines.

The TOS-Kurim works are built on the extensive site of the original Zbrojovka machine-tool and armament factory, where, it may be noted, the well-known Bren gun originated. These works, fully-equipped and actively exploited during the German occupation, were extensively damaged by bombing towards the end of the war, and after the cessation of hostilities, the present new and much larger factory was built.

Some 3,000 people are now employed here, and, in accordance with the practice prevailing in other Czech industries, two-shift working is in operation, to ensure efficient utilization of the available plant. The shift hours are from 6 a.m. to 2 p.m., and 2 p.m. to 10 p.m., with a break during each shift of only 15 min. Facilities are available in the factory canteens for obtaining meals at the end of the working period, and only one shift, from 6 a.m. to 11-45 a.m., is worked on Saturdays.

At the present time, basic research concerning machine-tool design and metal cutting tools is being carried out by two establishments in Prague, and another in Brno, the latter being mainly concerned with metal forming, forging, and press-work. A policy of decentralization is, however, now being carried out progressively in Czechoslovak industry generally, and a new administration and research block is being built at TOS-Kurim which will enable the factory to be self-supporting to a large degree.

In addition to well-equipped light and heavy machine shops and assembly bays, there is a large, modern mechanized foundry which is capable of supplying all the high-quality machine tool castings required by TOS-Kurim, and can also meet certain other outside requirements. The greater part of the foundry equipment was built in Czechoslovakia, but it may be noted that in the floor-moulding section for heavy castings there is a large American-built sand slinger, installed some 10 years ago, which is mounted on rails so that it can be power traversed from one mould to the next.

A general view of this machine is given in Fig. 1,

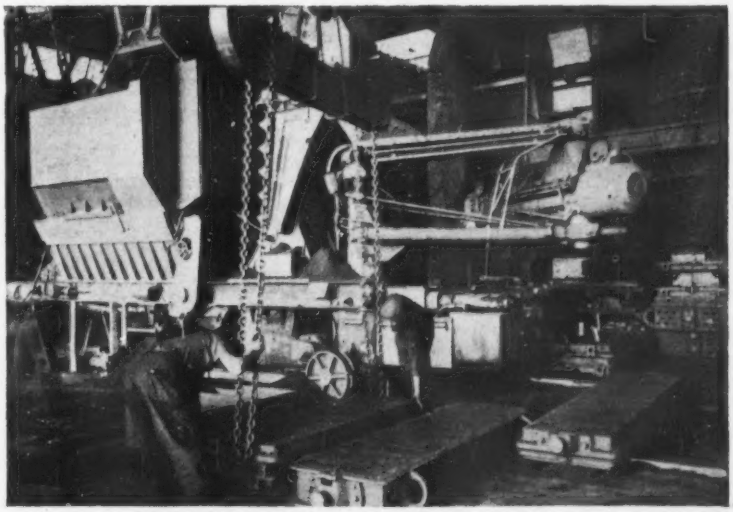


Fig. 1. A Large American-built Sand Slinger in Operation at the TOS-Kurim Machine Tool Works

Fig. 2. View of the Cupola Bay in the TOS-Kurim Foundry

and the operator has complete control of the unit from a seat on the slinger head, at the end of the articulated arm. The sand supply, taken from the main conditioning plant, is contained in a detachable hopper. A smaller sand slinger is installed for operation in conjunction with a roller conveyor system carrying medium-size moulding boxes, and there is also a machine moulding section with roller conveyor system and overhead ladle runways, for producing the smaller castings.

As may be seen from Fig. 2, supplies of metal are taken from tilting holding ladles, which are fed by two cupolas of large capacity. A hydro-blast installation is provided adjacent to the knock-out station for cleaning the castings before they are fettled and shot blasted. The employment of women as crane drivers, and in the core-making section, may be noted.

MACHINE SHOP EQUIPMENT

In the heavy machine shop, an appreciable proportion of the machine tools in use is of German origin, for example Billeter double-housing planers and slideway grinders, a Waldrich-Cobourg open-side hydraulic planer, Collet & Engelhard horizontal borers, and Kollmann plano-milling machines. Czech-built machines include a 5-in. spindle horizontal borer supplied by TOS-Varnsdorf, a 6-ft. 6-in. by 6-ft. 6-in. by 33-ft. planer, and double-column plano-milling machines.

Czech planers are built at the TOS-Holoubkov works, and the 33-ft. machine mentioned is a type HD20a, which can be supplied with planing lengths up to 40 ft. Steplessly-variable table speeds, up to 263 ft. per min., if required, are provided by Ward-Leonard control of the motor, the final drive being taken through a helical pinion and rack, and tungsten carbide tools can be used to full advantage. Steplessly-variable feeds, obtained hydraulically, are available for the cross-rail and side toolheads, and the toolboxes are arranged for hydraulic relief. Other features include automatic hydraulic clamping for the cross rail on the columns, and plastics-lined slideways for the table.

Up-to-date machine tools of all the types normally to be expected are also installed in the light machine shop. Many of them are of Czech make, while others are of German origin, including some from East Germany, which have recently been installed. The use of high-frequency induction heating equipment, developed in Czechoslovakia, may be noted, for hardening shafts, spindle and gears. There is also a unit specially designed for hardening the long boring spindles for the type HD80, 3½-in. spindle horizontal borers made by TOS-Kurim. In this application, the bar, suspended from a hook, is traversed vertically by means of a small motor in conjunction with a balance weight, cable, and pulley.

A batch of type HD80 horizontal borers, nearing completion in the assembly bay, is shown in Fig. 3. This machine, of a now well-established design, has 18 spindle speeds from 5·6 to as high as 1,000 r.p.m., which can be pre-selected, the change then being made electrically when a push button is pressed. A wide range of feeds, and rapid traverse, are available in all directions, and the motions can be tripped automatically by means of adjustable stops. Provision is made for thread cutting, and precision length bars and dial gauges can be employed for making accurate transverse

and vertical settings.

Plano-milling machines made by TOS-Kurim include the FP range, several of which are seen, under construction, in Fig. 4. This machine is available with table sizes of 35 by 118 in. and 50 by 140 in., and steplessly-variable table feeds from 1 to 30 in. per min. are obtained by Ward-Leonard motor control. Final drive to the table is transmitted by worm and rack. Rapid traverse is obtainable in all directions, and the cross rail is automatically clamped to the columns when a setting has been made. Two swivelling spindle heads, of unit construction, are normally provided on the cross rail, and a horizontal head on each upright. The drive to each head is taken through a gearbox from a 2-speed flange-mounted motor of 12/17 h.p., and the 19 spindle speeds range from 11 to 710, or 14 to 900 r.p.m.

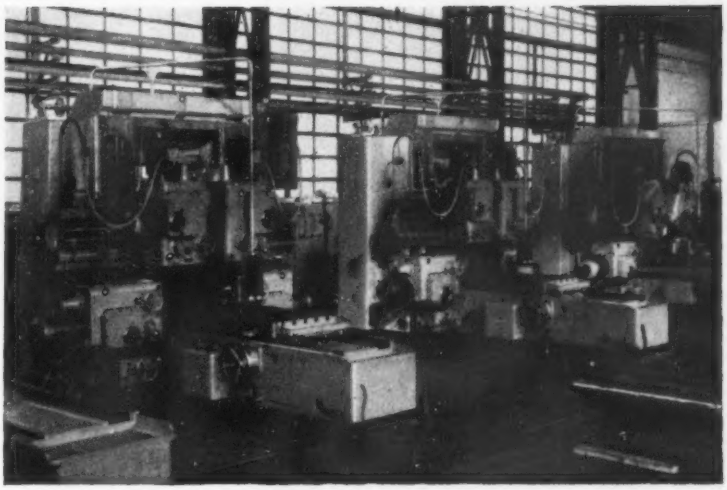


Fig. 4. Type FP Plano-milling Machines Under Construction at TOS-Kurim

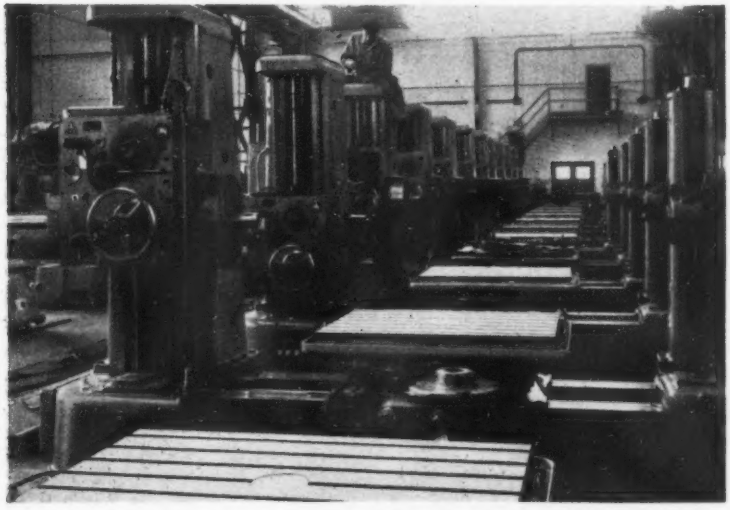


Fig. 3. A Batch of Type HD80 Horizontal Borers in the Assembly Bay at TOS-Kurim

HEAVY-DUTY MILLING MACHINES WITH HYDRAULIC MOTOR AND SCREW FEED

A recent development of interest in connection with knee-type milling machines is the introduction of the heavy-duty type FB50, with a 79- by 19½-in. table, which is to be made in vertical, also plain and universal horizontal, forms. The vertical machine, known as type FB50V, is shown in Fig. 5. A main driving motor of 40 h.p., and a range of 18 spindle speeds from 28 to 1,400 r.p.m., enable tungsten carbide cutters to be employed effectively for machining a wide variety of materials, with automatic table cycles if required.

Drive to the spindle is by belt to ensure smooth transmission, and torsional vibration is damped by means of a heavy flywheel, which, together with a multiple-disc clutch, is mounted between the centre and

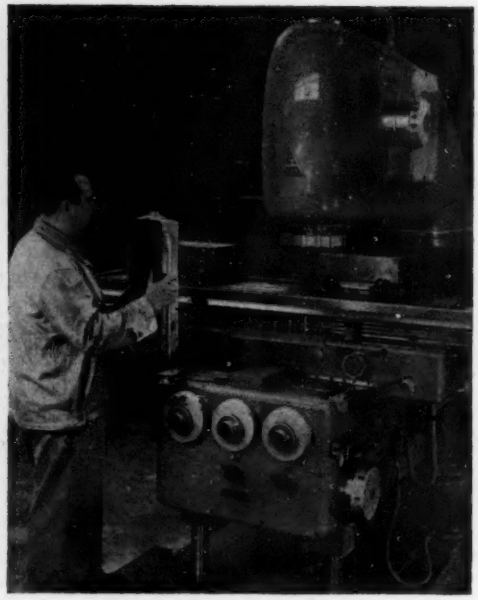


Fig. 5. The Recently-introduced FB50V Heavy-duty Vertical Milling Machine, with Hydraulic Motors and Lead Screws for the Feed Drives

rear spindle bearings. At the front, the spindle runs in a high-precision, double-row, roller bearing, and at the centre and rear, in taper roller bearings which take the thrust. All the shafts in the gearbox are mounted in roller bearings. Spindle speed changing is remotely controlled from the pendant panel, and the changes are effected by means of a hydraulic servo-motor system supplied from a 1½-h.p. pump unit.

Rapid traverse and steplessly-variable feed rates from 0·47 to 47 in. per min. are provided for the table in all directions, by means of hydraulic motors and lead screws, the feed required being selected on the pendant panel. Pressure oil for the hydraulic motors is supplied by a 7½-h.p. hydraulic pump unit housed in the knee. Large-diameter graduated dials on the front of the knee provide for accurate settings in the longitudinal, transverse, and vertical direction, and hydraulic clamps are provided for the knee and saddle. These clamps can be released by hand, if required, and are automatically engaged and disengaged when power adjustments are being made. As may be seen in the illustration, there are two substantial pillars for steadying the knee at the front.

A backlash eliminator is incorporated in the table drive, which is controlled by a handwheel on the knee, so that either conventional or climb-milling can be performed in either direction of table traverse. Another feature is a hydraulically-operated rise and fall movement of 0·020 in. for the knee, to prevent drag of the cutter over the work during rapid return of the table. This movement can be obtained from the control panel, or automatically during the table cycle, by means of trip dogs.

The type FA5 vertical, and plain and universal horizontal, milling machines are also built by TOS-Kurim, and a number are seen in the view of the assembly bay in Fig. 6. These machines have already been demonstrated in this country by the agents, the Selson Machine Tool Co., Ltd., at the 1956 International Machine Tool Exhibition. The table has a working surface of 78½ by 16¾ in., and the drive is provided by a motor of 15 h.p., or, if required, 20 h.p. There are 20 spindle speeds,

Fig. 6. Type FA5 Knee-type Milling Machines Built by TOS-Kurim

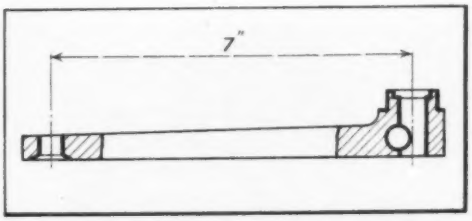


Fig. 7. Typical Bicycle Crank Machined at Each End on a TOS-Kurim Unit-head Machine

from 18 to 1,400 r.p.m., and the changes are made by a single lever in conjunction with a separate jogging motor with push-button control. As an alternative, automatic speed changing by means of a push-button controlled motor can be provided. An easily-read speed calculator is incorporated, which enables the operator readily to select the correct cutting conditions for the work in hand. Rapid traverse and power feeds in all directions are available for the table, the feed rate being selected by a single lever. Feed changing is facilitated by a jog button. Equipment available includes attachments for slotting, gear hobbing, and circular milling.

SPECIAL-PURPOSE UNIT HEAD MACHINE TOOLS

The design and construction of special-purpose machines incorporating unit heads is an important function of TOS-Kurim, and in this field development work is being actively pursued. An appreciable number of machines, covering a wide variety of products, has been built during the past few years for installation in Czech factories, also for customers abroad. Czech machine tool exports, it may be noted, now represent between 60 and 70 per cent of the country's total machine tool production, and the proportion exported from TOS-Kurim is nearly 80 per cent. West Germany is an important customer.

Unit heads suitable for drilling, reaming, boring and milling operations are made in a range of sizes, fitted with main driving motors from 1½ to 16 h.p. With the smaller types of units, the automatic feed and rapid traverse cycles for the spindle quills are obtained by means of cams, in conjunction with change gears which determine the cycle times. The larger units are mounted on slide bases, and the feed and rapid traverse motions are effected by lead screws coupled to motor-driven gearboxes, also of unit construction.

A range of units for light, medium and heavy duty, with spindle driving motors from 1½ to 15 h.p., is also made, with hydraulic feed by means of pistons and cylinders, and unit heads with lead-screw and hydraulic motor drives are also being developed. These hydraulic-feed heads can be equipped to perform step-by-step deep hole drilling operations.

For tapping, a head can be adapted by removing the feed cam and mounting an attachment carrying a lead nut on the front face of the head casting. This nut is engaged by a lead-screw sleeve on the spindle, to provide pitch control. A tapping head of ⅞-in. capacity, with built-in lead-screw and nut at the rear, is also made. In addition, fine boring machines of unit construction are included in the range. Some of the machines that have been built incorporating these unit heads, present features of interest, and will now be described.

EXAMPLES OF CZECH UNIT HEAD MACHINES

For boring and chamfering the centre hole, and drilling a series of bolt holes on a pitch circle, in pressed-steel wheel discs for motor cars and lorries, a horizontal duplex machine has been built which will handle 10 different types and sizes. Unit heads, of the lead-screw type, are equipped with universal-joint adjustable spindles. The latter carry combined drilling and facing tools which are guided in bush plates and produce spherical seats at each side of the wheel disc. The work is centred and clamped in the fixture by hydraulic means, and an output of 10 to 15 parts per hour can be obtained, depending upon the size of the disc.

A 3-way machine, equipped with a vertical head, and right- and left-hand horizontal heads, of the screw-feed type, has been constructed for drilling four holes in each flange, and four holes in the gland faces of valve bodies of various sizes, from ⅜ to 2 in. nominal bore diameter. Four universal-joint spindles are mounted on each head, and the workpiece is located by the flange peripheries in V-blocks on the fixture, and clamped against a fixed plate by raising the fixture by hand. An output of 600 valve bodies per shift can be obtained from this machine.

Bicycle cranks are machined at each end, at the rate of 110 per hour, on an indexing table machine equipped with four vertical heads and two horizontal heads. As shown in Fig. 7, the operations performed comprise drilling, chamfering, and tapping the hole at the pedal end; drilling, counterboring, and reaming the axle hole at the other end, turning and facing the spigot; and drilling the cross hole for the cotter pin. The workpieces are loaded into the fixtures, two at a time, and are clamped by hand. This machine is designed to handle two different sizes of cranks.

Fig. 8 is a close-up view of the spindle heads and work stations on a duplex horizontal machine designed for drilling 48 holes of 4·5 mm. (0·177 in.) diameter in a plate component of 53 mm. (2·087 in.) diameter by 6 mm. (0·236 in.) thick. The right- and left-hand unit heads employed are of the cam-feed type, and on the quill of each is mounted a 24-spindle head, with the spindles arranged in three groups of eight. Because of the close centres of the spindles, a gearless drive has been adopted for each group, with lubrication by oil mist. The drills are guided by spring-loaded bush plates sliding on round bars, and guide bars are provided to support the fairly heavy, overhung spindle heads. Each group of eight spindles is associated with a fixture station on a trunnion-mounted indexing carrier, and at a fourth station, the workpieces are loaded and unloaded, two at a time. Sixteen holes are drilled completely through the two plates at each of the three working station of the machine.

The work is held in screw-operated V-jaws, and the carrier is indexed by hand. A safety switch ensures that the machine cycle cannot start unless the carrier is properly located. At 85 per cent machine utilization, 100 plates can be drilled per hour.

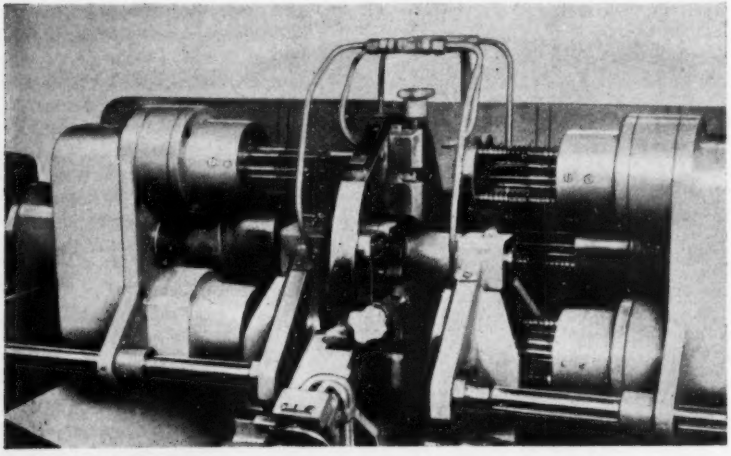


Fig. 8. Close-up View of the Spindle Heads and Work Stations of a Machine Designed to Drill 48 Holes in a Plate Component

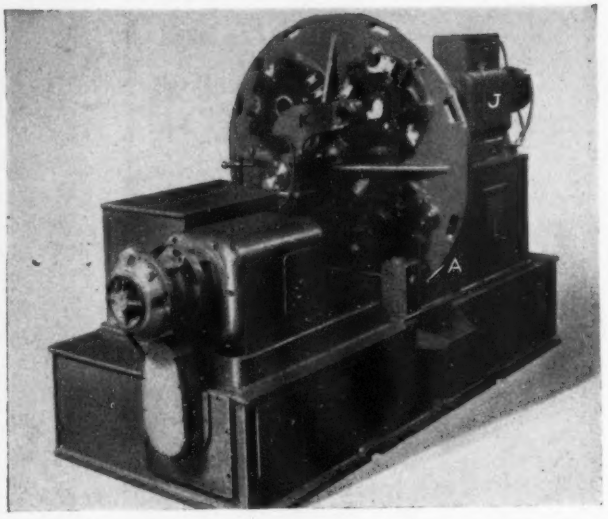


Fig. 9. Unit-head Machine for Boring and Facing Mining Truck Wheels

BORING AND FACING MINING TRUCK WHEELS

Fig. 9 shows a horizontal machine fitted with unit heads which has been built for boring and facing cast steel flanged wheels, of 16 in. outside diameter, required in appreciable quantities for mining trucks. The castings are held in hand-operated self-centring fixtures, on a 4-station drum, which is indexed by hand, and is provided with four location bushes for engagement by a hand-operated plunger at *A*.

Referring to the close-up view, Fig. 10, the casting, as received from the foundry, is loaded at position *B*, and is centred by three sliding jaws, as at *C*, and held against seating faces by three dog clamps *D*, applied to the flange face.

The fixture drum is indexed in an anti-clockwise direction as viewed in Fig. 8, and the first operation, comprising rough boring the cored

hole to 104 mm. (4·095 in.) diameter, and rough machining the face of the centre boss on the side opposite to the wheel flange, is performed by the rear spindle head *E*, Fig. 11. At the next station, *F* in Fig. 10, the hole is semi-finish bored to 109·5 mm. (4·31 in.) diameter and the other face of the boss is rough machined by the head *G*, at the front. Finally, at station *H*, the hole is finish bored to 110 mm. (4·331 in.) diameter, and the front and rear faces of the boss are finished machined, to give a width of 78 mm. (3·071 in.), by means of a tool bar in the spindle head *J*, Fig. 9, which is fitted with out-feeding facing tools. A tolerance of 0·0016 in. is specified for the bore diameter, and the tool bar is provided with a pilot extension which enters a ball-bearing mounted steady bush in the bracket *K*.

As may be seen in Fig. 10, a safety switch is provided at *L*, which engages a 4-lobe plate cam *M* on the spindle of the work drum, to ensure that the cutting cycle cannot be started unless the drum has been properly indexed. A boring speed of 230 ft. per min. is employed for roughing, and 360 ft. per min. for finishing, and the floor-to-floor time for the operation is 9 min. The three unit heads are of the screw-feed type, fitted with independent traverse motors, and the cycle of rapid approach, feed, and quick return is controlled by adjustable dogs. Driving motors totalling 30 h.p. are employed, and the machine weighs 6½ tons.

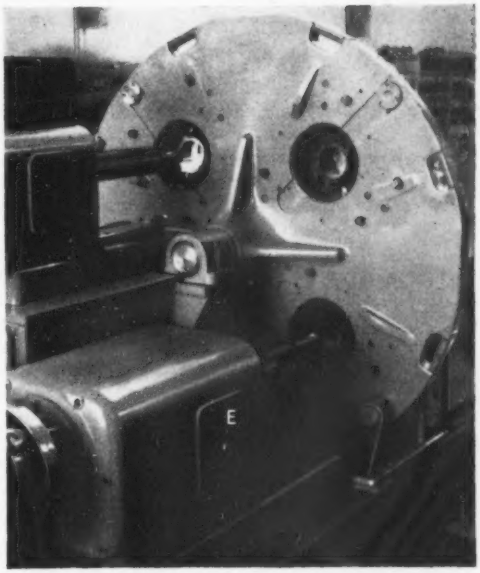


Fig. 11. Rear View of the Unit-head Machine for Boring and Facing Mining Truck Wheels

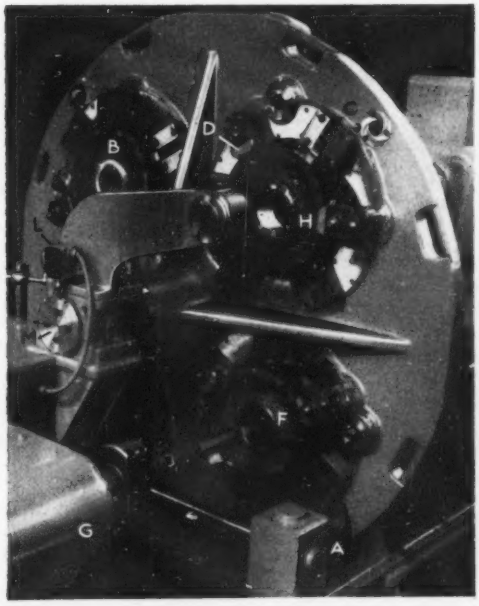


Fig. 10. Close-up View of the Fixture Drum of the Machine Shown in Fig. 9

BORING AND FACING OPERATIONS ON BICYCLE FRAMES

Another example of a special-purpose machine incorporating unit heads is shown in Fig. 12. This machine has five heads, mounted horizontally, for carrying out operations on a bicycle frame. Referring to the close-up view, Fig. 13, the operations performed comprise: (1) facing and counterboring, to 35 mm. (1·378 in.) diameter, each end of the hole at *A* for the bracket axle bearings, with front and rear spindle heads fitted with step-ground end mill-type cutters; (2) reaming the hole at *B*, to 21·1 mm. (0·87 in.) diameter for the saddle pillar, with a reamer guided in a bush, and (3) facing and counterboring each end of the frame tube, as at *C*, to 30·6 mm. (1·205 in.) for the fork stem bearings, with a step-ground cutter. The floor-to-floor time for these operations is approximately 2 min., and the tolerance for the bore diameters is 0·004 in.

The frame is located in V-seatings adjacent to the points *A*, *B* and *C*, and the clamps are applied

by means of air cylinders. To enable the cutters for the fork stem holes to be accurately aligned with the work, to ensure uniform metal removal from the tube bore, the cutter spindles run in bearing housings, as at *D*, which, together with the location block and clamp assembly, are carried on a vertically-movable base plate *E*, and the drive to the spindles is transmitted through universal-joint shafts *F*. A chute is provided, at *G*, to direct the coolant and swarf from the upper working station into the machine tray.

It may also be noted that unit heads have been incorporated in a 4-way horizontal machine for performing a comprehensive series of operations on a mowing machine component, and in an indexing-table, machine, designed to perform turning, boring, spot-facing, chamfering and tapping operations on five sizes of cast iron bodies for pneumatic door closing units. For the motor car industry, machines have been constructed for drilling and reaming valve guide holes in engine crankcases, for the step-by-step drilling of lubrication holes in crankshafts, and for drilling brake shoes and a variety of other components.

End-shields for small electric motors are completely machined at the rate of 500 per shift on a 6-station indexing-table machine, designed to handle two types and three sizes, other machines have been supplied for operations on various typewriter and sewing machine components, for milling

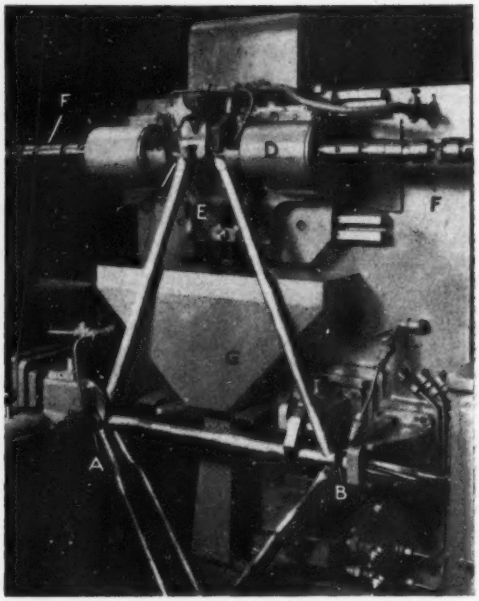


Fig. 13. Close-up View of the Machine Shown in Fig. 12. The Cutter Spindles in the Housings *D* are Driven Through Universal-jointed Shafts

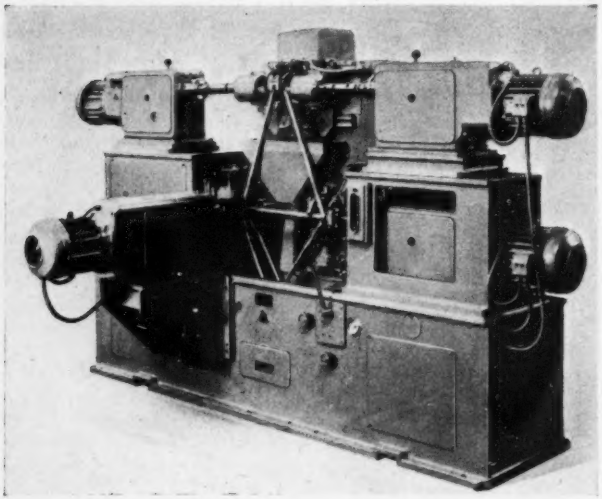


Fig. 12. Unit-head Machine for Performing Boring and Facing Operations on Bicycle Frames

turbine blades, and for drilling large pipe flanges. Multi-spindle heads with more than 60 spindles have been made.

IN-LINE TRANSFER MACHINE FOR CAST-IRON BEARING HOUSINGS

In addition to the variety of unit-head, special-purpose machine tools to which attention has been drawn, in-line transfer machines are now being built by TOS-Kurim, and the example shown in Fig. 14 has recently been completed to the order of a well-known company abroad, engaged in the manufacture of ball and roller bearings. This machine, which incorporates very up-to-date features, is designed to perform boring, facing, drilling and tapping operations on cast-iron bearing housings for railway axle bores.

These housings are of a cup shape, approximately 10 in. diameter by 11 in. long, and there is a large-

diameter taper-threaded hole in the closed end. Four bosses on the periphery at the front end are drilled and tapped to receive fixing studs for an end mounting, and there is a side boss, in which is machined a stepped, blind bore for a spigot, at right-angles to the main axis of the casting. The general form of the stepped bore which accommodates the anti-friction bearings is shown in the sketch, Fig. 15.

There are seven working stations, and loading and unloading stations, and the castings are clamped to platen-type fixtures which are returned empty to the starting end of the machine along an overhead runway, as seen at *A*, Fig. 14. The platens are traversed along this runway by means of dogs on a chain, and when a platen reaches the left-hand end, it is advanced on to a rising and falling table which is seen in the lowered position at *B*, level with the main bedways of the machine. Movement of the table up and down guideways on the outer face of the column *C* is effected by means of a screw, driven by a motor through reduction gears. A similar table arrangement is provided at the unloading end of the machine for lifting the empty platen to the level of the overhead conveyor.

The casting is located against front stop faces on the fixture, and is clamped from the rear by a 2-point balanced clamp applied to the radiused end face. After the workpiece has been loaded, the hexagon nut of the clamp is tightened automatically, when a push button is pressed, by means of a motor-driven nut runner in a left-hand head, which is advanced hydraulically to the work, along guideways located between the side members of the column *C*. A similar power-driven nut runner is provided at the opposite end of the machine, which comes into operation automatically to release the finished workpiece. The latter is then automatically removed from the platen by means of a hydraulically-operated unloader at *D*, comprising a pillar with a swivelling radial arm. At the outer end of the arm there is a vertical hydraulic cylinder, the piston rod of which is provided with a pivoted lifting finger. This finger engages the taper threaded hole in the casting, and after the latter has been lifted out of the fixture, the radial arm swings round and the casting is deposited on an outgoing conveyor. Only one operator, at the loading end, is thus required to tend the machine.

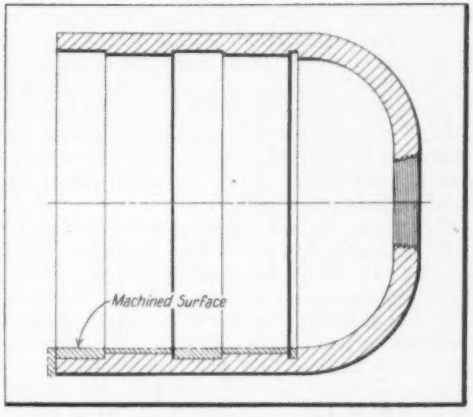


Fig. 15. Diagram Indicating the General Form of the Bore in the Bearing Housings

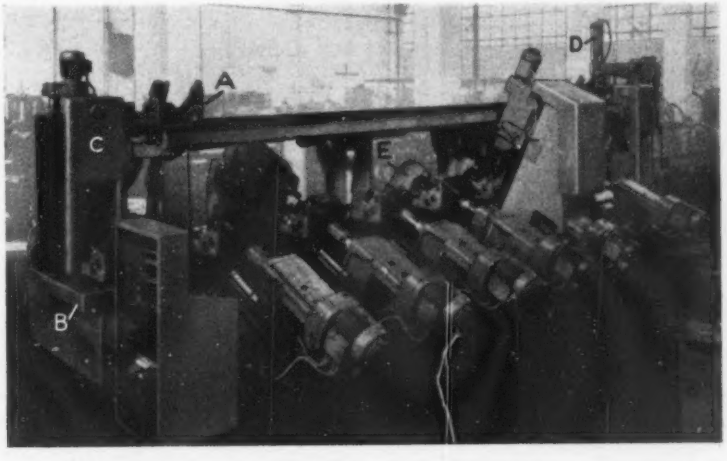


Fig. 14. In-line Transfer Machine Built by TOS-Kurim for Handling Cast-iron Axlebox Bearing Housings

It may be noted that the platens and spindle heads are inclined at an angle of 20 deg., to facilitate the clearance of swarf from the open end of the cup-shaped casting. Sheet metal cowls are provided on the bed at the front

position where boring operations are performed, and the swarf falls down chutes to a worm and trough type conveyor which carries it to the unloading end of the machine, where it is delivered into a bin. Ample time is available during the machine cycle of 3½ min. for the operator to remove any swarf from the fixtures by hand, before loading the castings, and no automatic cleaning station has therefore been provided.

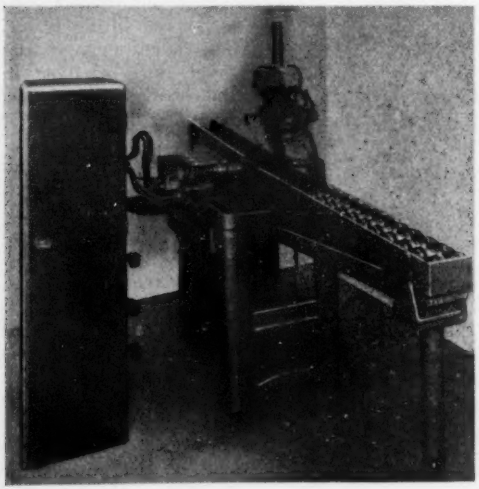
The platens are indexed from one station to the next, and clamped to the bed, by hydraulic means, and the unit heads for carrying out the various machining operations are also traversed hydraulically. On this machine, it may be noted, the bore diameters in the casting which accommodate the anti-friction bearings are only semi-finished, to a tolerance of 0·004 in. Subsequently, the castings are allowed to cool for about two hours to ensure accuracy at the finish-boring operation, which is carried out separately, on a special-purpose fine borer.

Out-feeding tool-heads produce the steps in the bore, and the taper thread in the end of the casting is cut with a single receding chaser. The four holes in the bosses are tapped under lead-screw control, and provision is made for adjusting the centres of both drilling and tapping spindles so that the machine can be tooled up for other types of axle-box housings. The semi-finish boring operations are performed with piloted tool-bars, which pass through the tapered end hole and enter ball-bearing mounted guide bushes in support brackets, as at *E*, on the bed. Oil mist lubrication is provided for the spindle bearings in the unit heads, and other refinements include built-in lighting units beneath the top beam which carries the platen return conveyor, to facilitate machine adjustment, and the provision of special gauging fixtures for pre-setting the tools in their holders before the latter are mounted on the spindles, in order to reduce the time required for tool changes.

Reference will be made in later issues of MACHINERY to Czech-built equipment employed in the production of Lada sewing machines, and for the manufacture of Skoda motor cars.

Automatic Drilling Machine for Gears

The equipment shown in the figure has recently been built by W. J. Meddings, Ltd., 16 Berkeley Street, London, W.1, for drilling oil holes in blanks for cluster gears, on a fully-automatic cycle.



Pacera Automatic Machine for Drilling Holes in Gears

This equipment is intended to be installed between an automatic lathe and a grinder in the production line, and functions without the need for an operator. When turning has been completed on the lathe, the blanks are loaded, one at a time, on to the left-hand end of the inclined chute, down which they roll by gravity. While drilling is being carried out on one component, other blanks in the chute are held by a series of stops which are operated by electrically-controlled air cylinders. These stops allow only one blank at a time to be passed, as required, to a position beneath the drilling spindle. The blank is then raised to the drilling position and held by a pair of centres, which are operated by separate air cylinders. Drilling of the cross hole, which extends into a central bore in the workpiece, is then performed by a Pacera spindle head fitted with a Pacera-Maxam air-hydraulic feed unit. Upon completion of the operation, the centres are automatically withdrawn, and the component is lowered, and then passed towards the right-hand end of the chute in readiness for transfer to the grinder.

The cycle time for drilling the oil hole is set to correspond with that for the turning and grinding operations. Normally, the air cylinders and associated micro-switches and cams are enclosed by a guard.

Savings in Material and Production Costs by Flow Turning

By J. GENIS* and W. MALLINDINE*

Flow turning, or "rotary extrusion" as the process is termed by the Aircraft Engine Division of Ford Motor Co., U.S.A., enables hollow parts of circular cross-section, with straight sides, to be produced from blanks, drawn cups, welded cylinders, forgings, or castings. Also, when the machine is equipped with a contour-tracing attachment, curved longitudinal profiles and multiple diameter forms can be produced. With conventional spinning, reduction in the thickness of the metal is only slight, whereas large reductions are possible with flow turning. The metal undergoes a shear deformation, under pressures up to 50,000 lb. per sq. in., and the diameter of the finished part is equal to that of the blank.

It has been found that thickness can be reduced by 75 per cent or more, in one pass, depending on the characteristics of the metal when flow turning cones from flat blanks. In these circumstances, the reduction in thickness follows a sine law, the wall thickness T_1 of the finished part being equal to the thickness T of the flat blank × the sine of half the included cone angle of the workpieces. By using preformed blanks, cones of varying wall thickness can be produced.

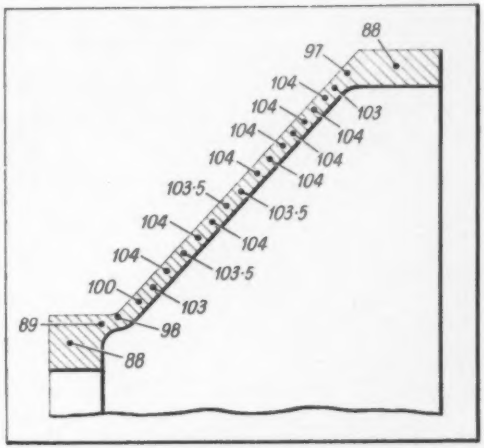


Fig. 1. Hardness Readings (Rockwell B Scale) Obtained on a Sectioned Part Made from AMS 6322 Steel by Flow Turning

Cold-working during rotary extrusion results in substantial increases in the tensile strength and fatigue resistance of the metal. In addition, the hardness of the material is increased, as indicated in Fig. 1, which shows a cross-section of a gas turbine, part, flow turned from a pierced and annealed plate of AMS 6322 alloy steel. Despite the high forming pressures employed,

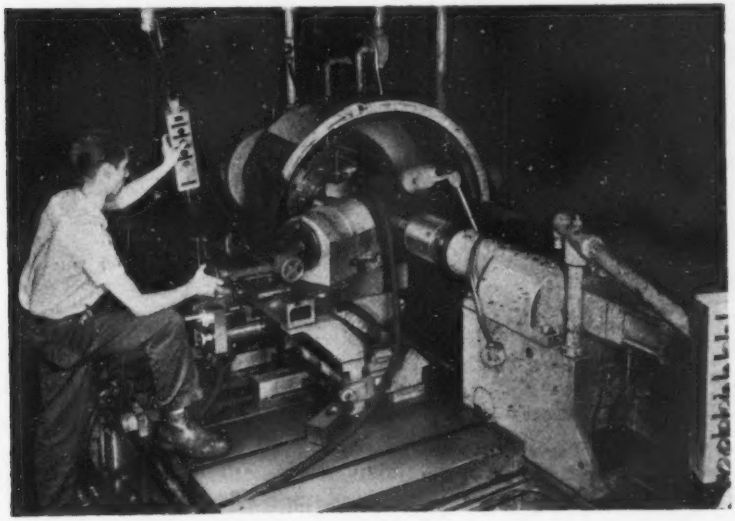


Fig. 2. Floturn Lathe Equipped with a Tracing Unit to Provide for Contour-forming. The Blank is Hydraulically Clamped Between the Tailstock and the Mandrel

* Aircraft Engine Division, Ford Motor Co., U.S.A.

micro-structure analyses of stressed parts have shown no evidence of fractures developing in the crystalline structure.

Regardless of the material which is being flow turned, the dimensions of the finished part depend on the accuracy of the mandrel and the path of the pressure roll. Wall thickness and inside diameter can easily be held within ±0·002 in. The surface finish obtained depends on the material being flow turned, the rate of feed, and the roller design. An incorrectly shaped roll may undercut the blank, with the result that burrs are formed and a rough surface is produced. Feed rates ranging from 0·005 to 0·100 in. per rev. have been used, but the best results are obtained with feeds from 0·010 to 0·050 in. per rev. Speeds range from 1,500 to 2,250 surface ft. per min.

Flow turning is performed on Floturn lathes made by the Lodge & Shipley Co., and Hydrospin machines made by the Cincinnati Milling Machine Co. On the Floturn lathe, as seen in Fig. 2, the blank is hydraulically clamped between the ram on the motor-driven screw-operated tailstock and the formed mandrel which is mounted on the headstock. The mandrel and work are rotated by the headstock spindle, which is driven from a D.C. motor through a variable-speed unit, and any speed from 33 to 1,000 r.p.m. can be obtained. Blanks up to 42 in. diameter can be handled, and parts up to 50 in. long can be produced.

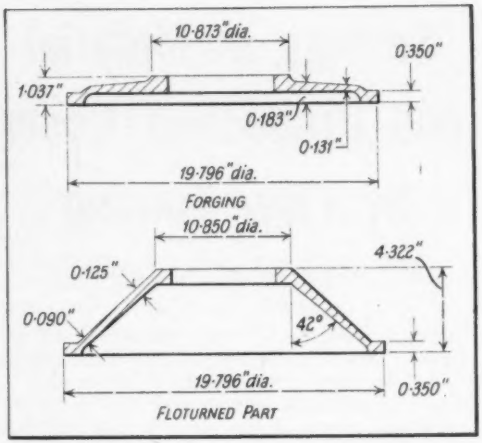


Fig. 4. Dimensions of Forging and Completed Intermediate Bearing Support. Previously, the Part was Machined from a Forging of the Required Depth

A hardened and ground roller, of 10 to 12 in. diameter and mounted on Timken roller bearings, is power-fed parallel to the surface of the mandrel to form the metal. The independent forming-roll unit can be pivoted on its bed, so that the roll can be fed to mandrels with various included angles up to 100 deg. Rotation is imparted to the roller by friction due to contact with the work. Pick-off gears in the forming-roll slide enable the feed rate to be varied from ¼ to 9 in. per min. A large handwheel, seen in Fig. 3, moves the roller towards or away from the work, and automatic stops limit the roller travel.

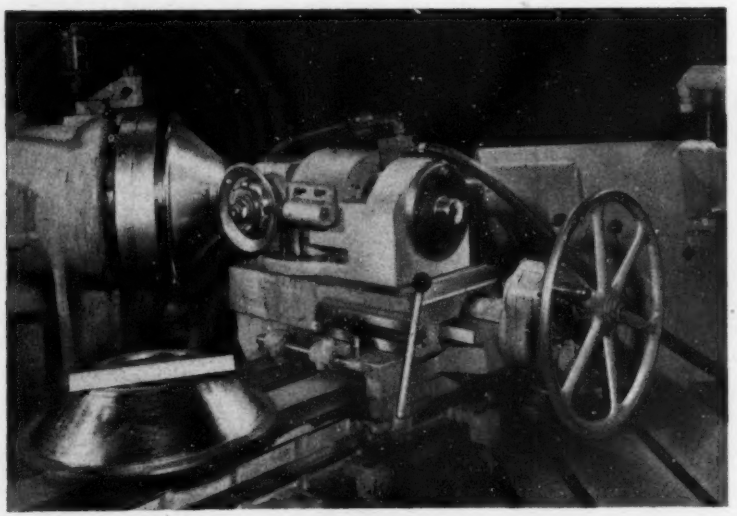


Fig. 3. Intermediate Bearing Supports are Power Roll-formed from AMS 6322 Alloy Steel Forgings on this Floturn Lathe. A Saving of $18 on Each Component is Obtained

Typical of the many gas turbine parts which are being produced on Floturn lathes is the intermediate bearing support, seen on the machine in Fig. 3. Made from AMS 6322 alloy steel, this part was formerly forged to the

required height and included angle, and then machined. It is now flow turned from a simple, flat forging, shown in section in the upper view in Fig. 4. This change-over has resulted in a saving of approximately 18 dollars per forging, and there has also been a reduction of about 3 man-hours in the time required to produce each part. Flow turning is also being employed with advantage for the production of bullet-nosed, combustion-chamber liners, approximately 5¾ in. long by 2¾ in. diameter, from Inconel. The liner was formerly made in two portions, which were joined together by fusion welding. Now, a blank is produced from 0·076-in. thick sheet stock, and pre-formed as seen at the left in Fig. 5, in readiness for flow turning with the set-up shown in Fig. 6. This change in procedure has eliminated 10 operations, and has resulted in a saving of 40 per cent in production time.

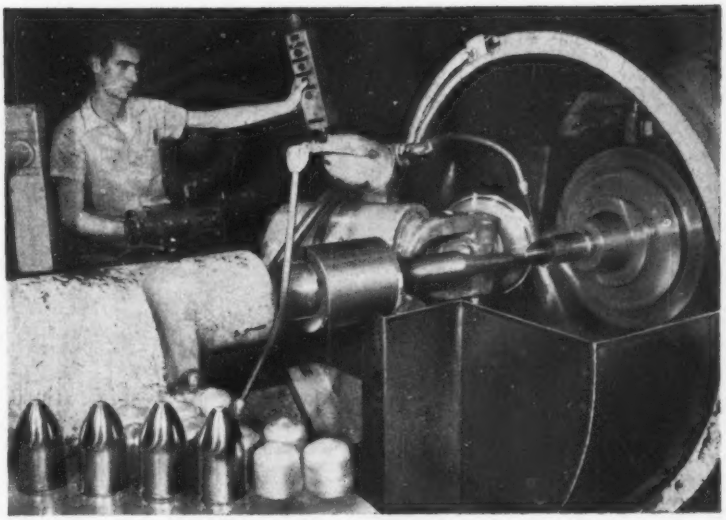


Fig. 6. Flow Turning Set-up for Inconel Combustion-chamber Liners. This Method has Resulted in a Saving of 40 per cent in Production Time

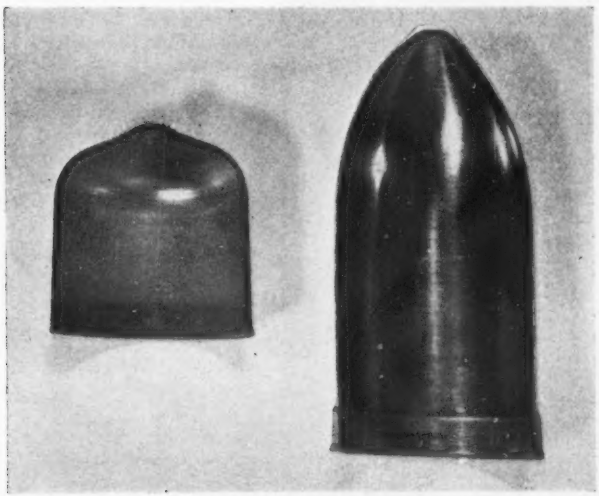


Fig. 5. Combustion-chamber Liners were Formerly Made in Two Sections and Welded Together. These Parts are Now Flow Turned After Preliminary Blanking and Preforming

Engineers in the Semi-Production Department of the Ford Aircraft Engine Division designed and built a special mechanical tracing unit for this operation. The unit is powered by the longitudinal feed screw of the Floturn lathe, and a cam is employed to control the contour when the round nosed portion of the combustion-chamber liner is being formed. The straight portion is produced by the tube-turning technique.

Tube-turning is essentially a process of continuous point extrusion, the amount of reduction in material thickness possible depending on the pressure capacity of the machine and the ductility of the material that is being formed. Reductions of as much as 88 per cent have been obtained with AISI 4130 steel without annealing the workpiece between passes.

Flow turning of the Inconel combustion-chamber liners is performed with the work rotating at 850 r.p.m., and the forming roller is fed at the rate of 4½ in. per min. The flat-sided

roller has a full semi-circular periphery with a radius of 0·250 in.

With the Cincinnati Hydrospin machine, the desired shape of workpiece is spirally generated by two opposed forming rollers, as seen in Fig. 7. The roller slides can be set parallel to each other for tube-turning parts up to 42 in. diameter, or at one-half the included angle for producing conical parts. If the design of the part permits, moreover, the front slide may be set for one forming operation, and the rear slide can be set to carry out a subsequent operation. The main slides of the machine are of the universal type, so that parts can be flow turned with their formed surfaces parallel to, at right angles to, or at any other angle to the centre line of the headstock and tailstock assemblies of the Hydrospin machine.

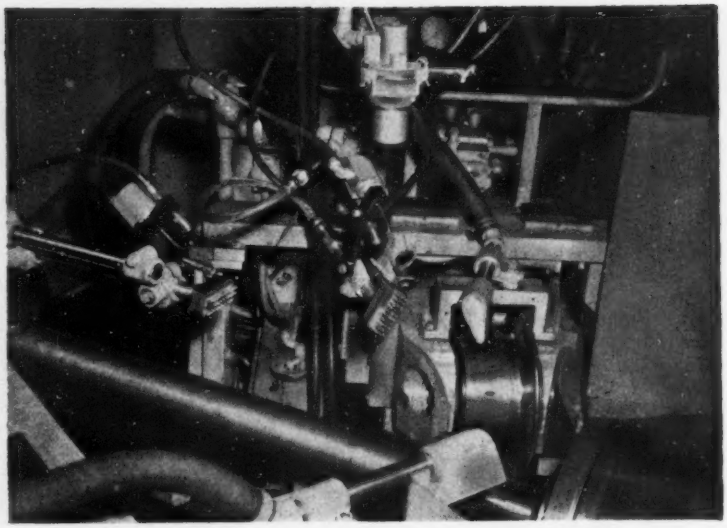


Fig. 8. When Hydrospinning Titanium Parts, Torches are Employed to Pre-heat the Blanks and Maintain them at a Temperature of 1,000 deg. F. during the Forming Operation

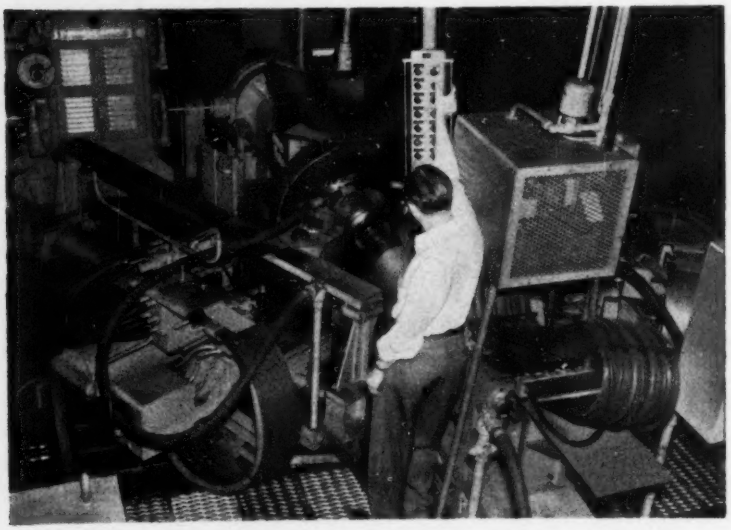


Fig. 7. Two Opposed Forming Rollers and a Hydraulic Contour-tracing Attachment are Employed to Generate Parts of Various Shapes

Equipment for the Hydrospin machine includes a hydraulic contour-tracing attachment which can be mounted on either cross-slide. In addition, end-mounted rollers are available for internal upsetting and flanging operations. The spindle speeds are steplessly-variable from 116 to 465 r.p.m. and the feed rates (also steplessly variable) range from 0 to 35 in. per min. for the cross-slide, and from 0 to 52 in. per min. longitudinally for the saddle. Workpieces up to 42 in. diameter can be swung.

A Flamatic attachment, seen in Fig. 8, has been provided for flame heating titanium parts during flow turning. Torches, each of which has 30 flame tips,

are used to pre-heat the titanium blanks and maintain them at a temperature of 1,000 deg. F. during flow turning. The temperature is controlled by a Ray-O-Tube indicator. Oxygen, under a pressure of 50 lb. per sq. in., is mixed with town's gas (15 lb. per sq. in.) in the ratio of 1·7 to 1. The consumption of oxygen is about 12 cu. ft. per hour, and of gas, 7 cu. ft. per hour.

A set-up for flow turning a rear bearing support for a gas turbine compressor is illustrated in Fig. 9. These supports are made from AMS 5613 stainless-steel forgings, which are pre-machined. During flow turning, the thickness of the wall is reduced from 0·234 to 0·110 in. and the bore diameter of 14·975 in. remains unchanged.

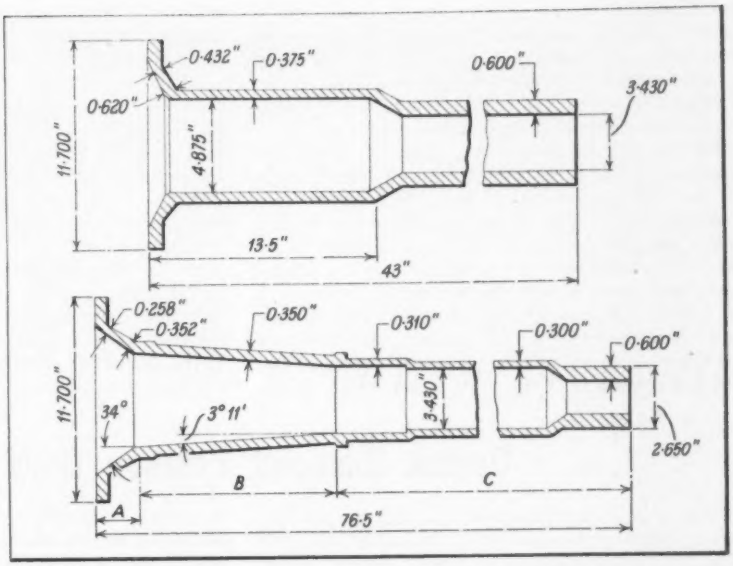


Fig. 10. The Gas Turbine Drive-shaft, seen in the Lower View, is Flow Turned from a 43-in. Long, Upset and Pierced Forging of Alloy Steel

Johnson's Wax-Draw, a non-drying, non-hardening drawing compound, is brushed on both sides of the machined forging prior to flow turning, and a flow of soluble-oil coolant is applied to the work during the operation. The workpiece is rotated at 400 r.p.m. and the rollers are fed at the rate of 2 in. per min. with the main slides set at an angle of 28 deg. and the cross-slides at 10 deg.

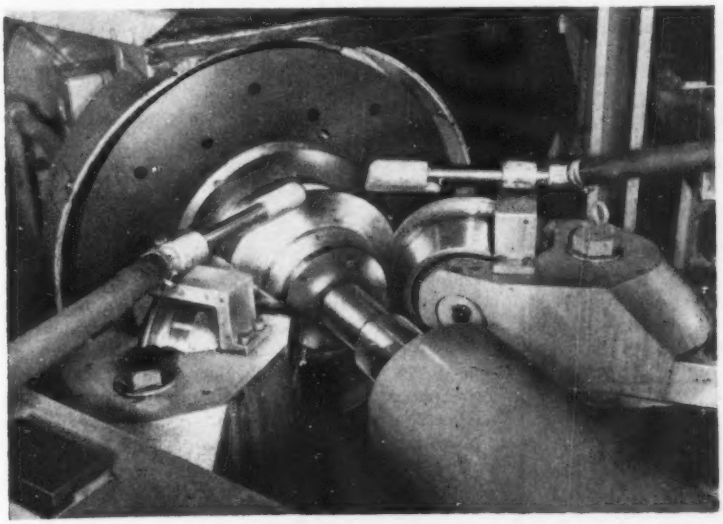


Fig. 9. Set-up for Flow Turning a Rear Bearing Support for a Gas Turbine Compressor from a Pre-machined Forging of AMS 5613 Stainless Steel

Very favourable results have been obtained in the experimental Hydrospinning of long drive-shafts for gas turbines. Starting with a 43-in. long, upset pierced forging of AMS 6415 alloy steel, as seen at the top in Fig. 10, the shaft is flow turned to an over-all length of 76·5 in. as shown in the lower view. When the shafts are produced in this manner no further

machining of the bores is required, apart from a short splined section. Consequently, special contour-boring lathes are not required and there is a considerable saving in machining time. Eventually, it is hoped to limit the external machining of the extrusion to critical surfaces only.

Of interest in connection with this particular application is the fact that three different forms of flow turning are employed. In "power roll-forming" the portion *A* (the large diameter 34-deg. angle, flanged end of the shaft), metal is displaced by "shear-spinning" in accordance with the normal sine-law theory previously described. Portion *B*, of 3-deg. 11-min. angle, however, must be "downhill" flow turned. In effect, this procedure is a complete reversal of the sine-law theory. The tubular portion *C* of the shaft is formed by "tube-spinning" which merely involves increasing the length of that portion of the workpiece by reducing the wall thickness.

Mandrels for flow turning are made from a chromium-molybdenum alloy steel, AISI 4140, and surface-hardened to between 56 and 59 Rockwell C, prior to grinding. Rollers, or tool rings, are made from Graph-Mo tool steel supplied by the Timken Roller Bearing Co., and hardened to between 63 and 65 Rockwell C.

The geometry of the rollers is an important factor in obtaining good results with flow turning. In general, a good starting point for "shear-spinning" is a radius on the roller equal to the thickness of the material to be displaced. For "tube-spinning," the radius should be about twice the material thickness.

Unidex Diamond Position Control

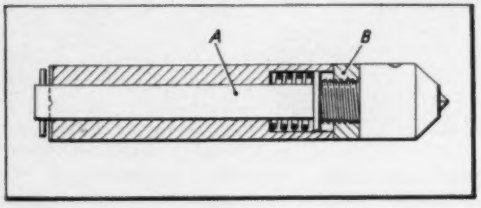
The Unidex diamond holder, which has recently been placed on the market by Universal Diamond Co., Ltd., 15 Rodmarton Mews, Baker Street, London, W.1, for wheel dressing on grinding machines, enables the diamond to be readily indexed through 90 deg. when part of its surface has become worn so that a fresh edge is presented to the wheel.

The subject of a patent application, the holder is intended to be inclined at an angle of 10 deg. to the horizontal plane, and since there are four indexing positions, corresponding to the number of natural facets on a diamond, equally-spaced flats are produced on the stone as a result of wear. The entire holder is then turned through an angle determined by the positions of two numerals marked on the shank, so that an edge between two of the flats is presented to the wheel. When this edge has become worn, the diamond can be again indexed so that other edges are brought into use in turn. In this way, a total of eight different portions of the diamond can be utilized before re-setting becomes necessary.

Referring to the sectional view of the holder shown in the accompanying figure, the diamond is mounted in an end piece attached to the spindle *A*, which is threaded for part of its length, and is housed in the bore of the hollow shank. The end piece is located in the different indexing positions by a cross pin at the rear end of the spindle *A* which engages with shallow slots in the end face of the shank. When the diamond is to be indexed, the knurled locking ring *B* is turned so that it moves towards the end piece. The latter can then be moved axially through a short distance to bring the cross pin clear of the slot, after which it is turned through 90 deg. so that the diamond is set in a fresh position. When the end piece is released, the pin is held in the next slot by a compression spring while the locking ring is being tightened against the end of the shank.

Since indexing is carried out entirely from the nose end, the holder may be fitted to tool posts with blind holes, if required. A gold-coloured spot is provided on the front piece, which should be set upwards when the holder is secured in the tool post.

The company can supply a complete range of diamonds for all types of wheel dressing duties. Furthermore, diamonds for wheel dressing operations on various makes of thread grinders, and for use with certain types of profile wheel dressers and hardness testers, are also available. In addition, the range includes diamond-impregnated grinding wheels, diamond hones and drills, and diamond powder.



Sectional View of the Unidex Diamond Position Control which Allows Eight Portions of the Diamond to be Used

Micyl Blocks for Measuring Tapers

In an article on Methods and Equipment for Checking External Tapers, published in MACHINERY, 92/483—28/2/58, reference was made to the Micyl blocks, developed by Laboratoire Central de L'Armement, Paris, which facilitate checking round components with external tapers, up to 90 deg. included angle, also curved forms such as cams and templates, polygonal tapered forms, and internal and external dovetails. In conjunction with wires of appropriate diameter, moreover, taper screw threads can be measured. The blocks are being made by the French firm La Précision Méchanique, who are represented in this country by Engineering & Scientific Equipment, Ltd., 33 Minster Road, London, N.W.2.

A pair of Micyl blocks of the latest design is shown in Fig. 1, and the essential dimensions are indicated in Fig. 2. The method of measuring a tapered part resting on its lower end face is indidated in Fig. 3. An important feature of these blocks is that the distance D, between the axes of the two movable cylinder halves will not alter regardless of the angle through which either half cylinder is turned in its V-base member. The lower surface and vertical outside face of each base member are ground accurately square to each other, and the distance $W/2$ and h are the same for any pair of blocks, and are stated to be accurate within 0·00002 in. Arms at each end of the base retain the half cylinder in position but allow it to turn freely.

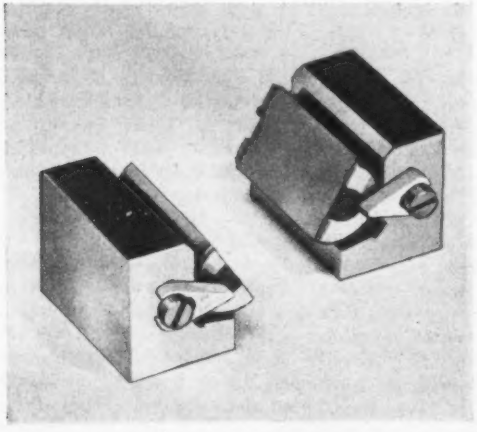


Fig. 1. A Pair of Micyl Blocks Made by La Précision Mécanique, which Considerably Facilitate the Checking of Tapers and Curved Surfaces

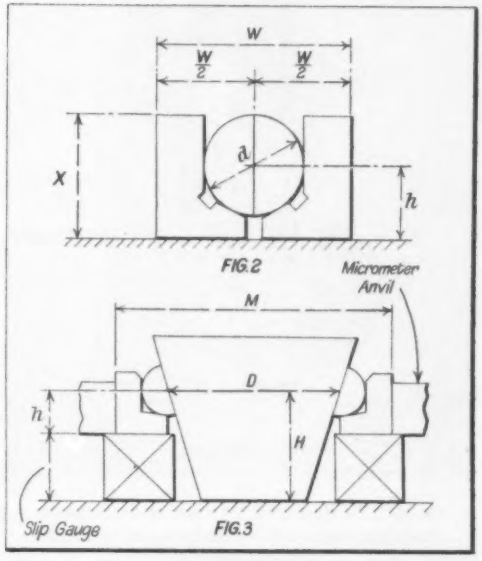


Fig. 2. Reference Dimensions of a Pair of Blocks.
Fig. 3. Diagram Showing the Method of Use

The dimension D, Fig. 3, at a height H from the face of a taper gauge, for example, is thus readily determined by measuring the distance M with the aid of a micrometer, and subtracting the constant W. If another measurement is then taken, at a different known height, the angle of the taper can be obtained.

Three sizes of Micyl blocks are made. The type A is designed for mounting on standard slip gauges, and measurements are taken with a micrometer or vernier caliper held in the hand. Dimensions of these type A blocks are as follows: $W=14$ mm. (0·551 in.), $X=8$ mm. (0·315 in.), $h=5$ mm. (0·197 in.), and $d=6$ mm. (0·236 in.). Type B Micyl blocks, which are larger, are intended for use in measuring machines, and have the following dimensions: $W=20$ mm. (0·787 in.), $X=11·5$ mm. (0·453 in.), $h=7$ mm. (0·276 in.), $d=8$ mm. (0·315 in.). For type C blocks, which have recently been added to the range, $W=26$ mm. (1·02 in.), $X=15$ mm. (0·59 in.), $h=10$ mm. (0·39 in.) and $d=15$ mm. (0·59 in.).

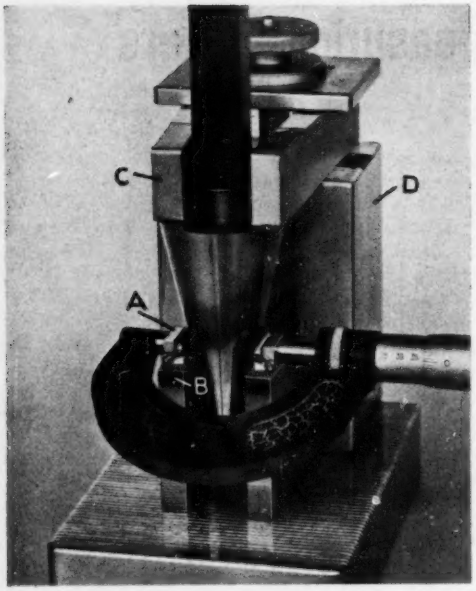


Fig. 4. The Special Stand which is Available for Checking Components with Reference to the Large-diameter End Face

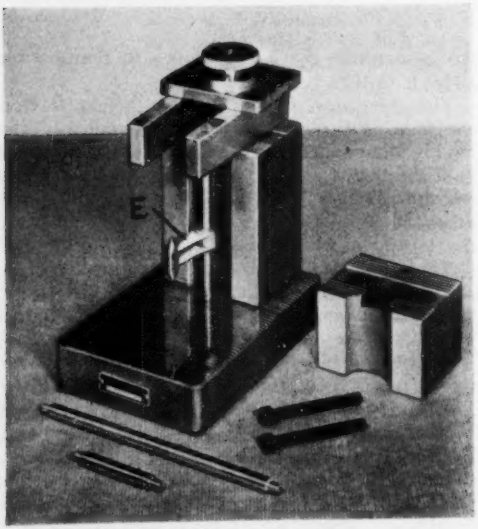


Fig. 5. View of the Stand, Showing the Lower Flexible Support Arm which can be Adjusted and Clamped on a Vertical Rod

To facilitate the checking of tapered components with reference to the large-diameter end face, the company have developed a special stand which is seen set up for measurement of a gauge in Fig. 4. Here, the Micyl blocks *A* rest on slip gauges *B*, of appropriate height, and the taper gauge is located against the underside of two blocks *C*. The latter are held by a clamp plate on top of the vertical block *D*, which is of a specified height and is attached to the base by means of two screws.

As may be seen in Fig. 5, the gauge to be checked is supported from beneath by a centre mounted on a double leaf spring arm *E*, which can be adjusted and clamped on a vertical rod at such a height that the taper gauge is held in contact with the blocks *C*.

Two different sizes of vertical reference blocks *D* (Fig. 4) are provided, with heights of 50 mm. (1·968 in.) and 100 mm. (3·937 in.), and they may be used together if a height of 150 mm. (5·906 in.) is required. A disc adapter is also supplied which fits on the lower centre, for supporting components without centre holes.

ULTRASONIC TECHNIQUE FOR MEASURING ELASTIC MODULI. Two research scientists, Mr. H. J. McSkimen and Mr. W. L. Bond of the Bell Telephone Laboratories, U.S.A., have developed a new technique for accurately measuring the elastic moduli of small specimens of diamond and other materials.

With the aid of auxiliary equipment, series of measurements can be made under widely differing values of temperature and pressure. Short trains of high-frequency ultrasonic waves are transmitted into the specimen and their velocity of propagation is determined. From the results, and the known density of the specimen, the elastic moduli can be calculated. For diamond, both longitudinal and shear waves were applied, to enable the three elastic moduli to be determined.

Flat and parallel surfaces were formed on opposite sides of the diamond specimen and its thickness was accurately measured. It was then secured to one end of a "buffer" rod of fused silica by means of a thin film of viscous fluid. A suitable quartz transducer was attached to the opposite end of the rod. Repeated trains of ultrasonic waves, at frequencies up to 200 megacycles per sec. were transmitted along the rod. These wave trains were principally reflected from the interface of the rod and specimen, but were also partially transmitted into the specimen, and reflected to and fro between the parallel surfaces.

Machine Shop Patents

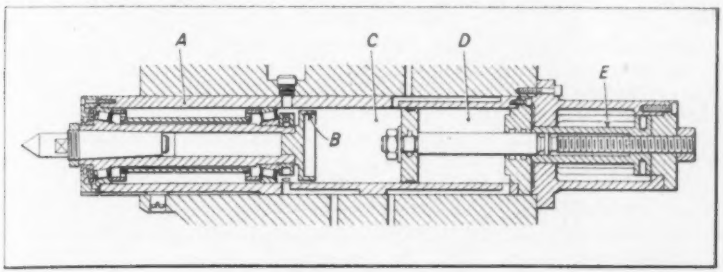
A HYDRAULICALLY-OPERATED TAILSTOCK QUILL

In this hydraulically-operated tailstock, a sectional view of which is shown in the figure, the axially-sliding quill *A* serves as a double-acting cylinder, housing a stationary piston and rod. A freely-rotating spindle carries the tailstock centre, and is fitted with a flange *B*, which has a small diametral clearance in the bore of the quill *A*. The latter is advanced when pressure oil is admitted to the chamber *C*, and when the centre engages the workpiece, pressure continues to act on the face of the flange *B*, to relieve the tapered-roller bearings of axial load. A pressure seal is provided in the nose of the quill and serves to prevent the escape of oil which passes the periphery of the flange *B*.

To retract the quill, pressure oil is admitted to the chamber *D*, and the extent of this withdrawal movement is limited by the sleeve *E*. This sleeve can be screwed along the piston rod, and is shown in its extreme right-hand position. To limit the forward movement of the quill, the piston and rod can be adjusted axially, the rod being threaded and engaging with a tapped hole in the end cap. A nut on the outer end of the piston-rod serves to lock the latter in the required position.

With this arrangement, clearance between the periphery of the quill *A* and the tailstock casting can be kept to a minimum, as the former is required to slide only. In addition, the bearings are relieved of most of the end thrust, so that wear is reduced, and concentricity maintained.

786,210. La Précision Industrielle, 196 Avenue Paul Doumer, Rueil-Malmaison, Seine-&-Oise, France. [*Application date, January* 19, 1954. *Published, November* 13, 1957.]



Sectional View of a Hydraulically Operated Tailstock which Incorporates a Double-acting Cylinder

A COMPENSATING MECHANISM FOR PITCH ERRORS IN THE LEADSCREW OF A THREAD-CUTTING MACHINE

The drawing shows, at *X*, a sectional view of the leadscrew drive of a thread-cutting, or grinding, machine, on which the motion is transmitted through gearing and a differential unit. If the outer casing of the differential is held stationary, the differential acts as a coupling, and drive from the spur gear *A* is transmitted to the leadscrew at a ratio of 1:1, but in the opposite direction of rotation.

A non-self-locking worm *B* meshes with teeth cut on the periphery of the differential casing, and on the outer end of this worm is keyed a plain spur gear *C*, as can be seen in the view at *Y*. Meshing with the gear *C* are two rack-toothed plungers, each of which has a roller at the lower end making contact with one of a pair of templates *D* and *E*. As the gear *A* starts to rotate, the outer casing of the differential will turn in the same direction, rotating the worm *B* and spur gear *C* until one of the plungers makes contact with a template. When this occurs, the worm *B* can no longer rotate, and the outer casing of the differential is held stationary. Drive to the leadscrew is now transmitted in the manner previously described.

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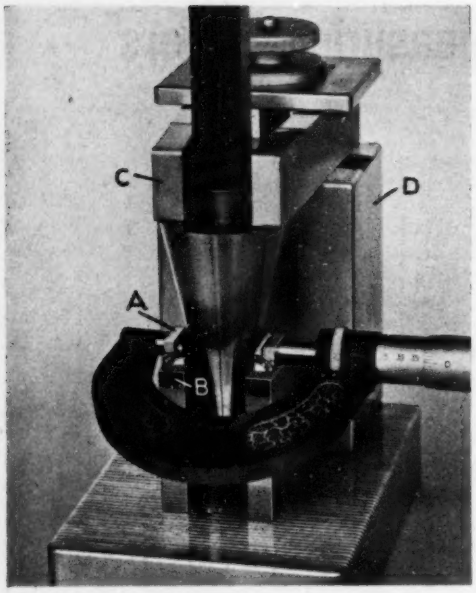

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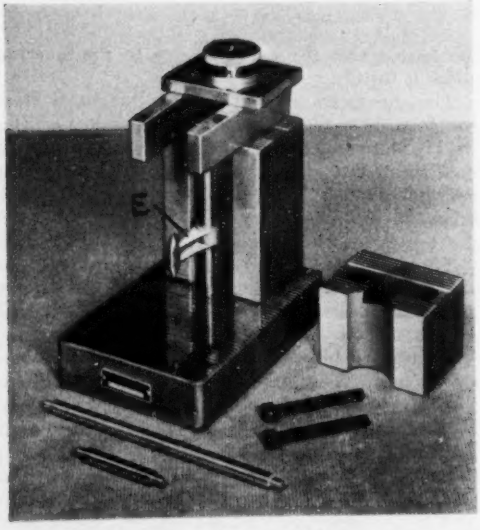

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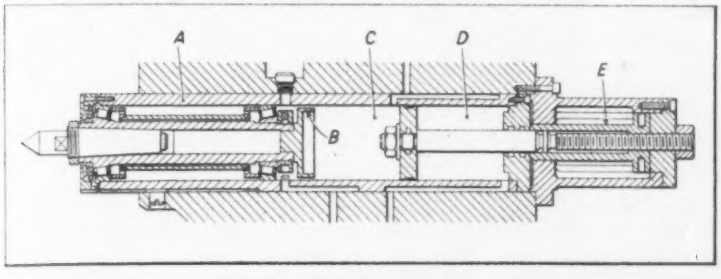

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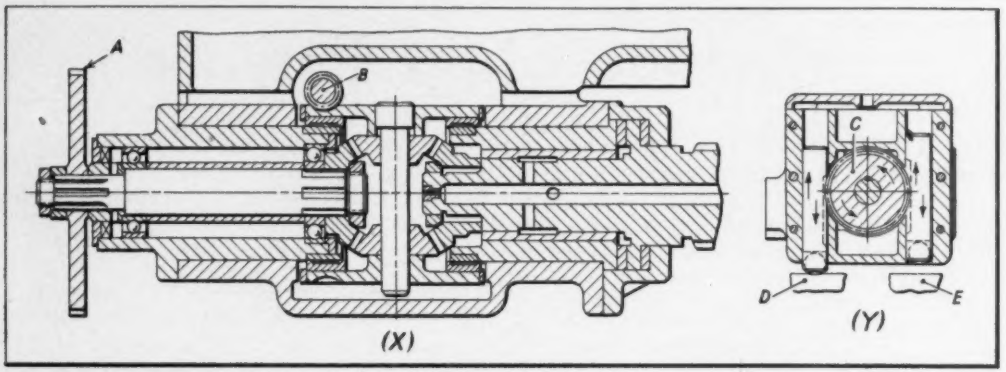

Sectional Views of a Compensating Mechanism for Pitch Errors in the Leadscrew of a Precision Thread-cutting Machine

which, in turn, rotates the worm *B*, and thus the outer casing of the differential. This rotation has the effect of adding to, or subtracting from, the rotary movement of the leadscrew, and correspondingly reducing or increasing the axial traverse of the carriage, thus compensating for the pitch errors. In the view at *Y*, one of the plungers has encountered a concave curve on the template *D*, which has resulted in an anti-clockwise rotation of the gear *C*.

Owing to the backlash which must be present between the leadscrew and its associated nut, one flank only of the thread is in use for each direction of carriage traverse. Two templates are necessary, therefore, to compensate for the pitch errors present on each flank of the leadscrew.

[789,364. Herbert Lindner, G.m.b.H. Lubarserstrasse 8-38, Wittenau, Berlin. [*Application date, May* 28, 1955. *Published, January* 22, 1958.]

E.M.I. Control System for Skin-Milling Machines

Vertical milling machines which incorporate the electronic control system that has been developed by E.M.I. Electronics, Ltd., Hayes, Middlesex, are already in use in this country and overseas. Recently, the company, in collaboration with the Cincinnati Milling Machine Co., Cincinnati, Ohio, U.S.A., has developed a data control system suitable for use with large skin-milling machines of the type used for operations on large aircraft components. The first four data control systems for machines of this type have been completed at the Hayes factory of E.M.I. for eventual delivery to the Air Materiel Command of the United States Air Force, and additional orders have been received.

It is stated that the basic E.M.I. electronic system has only been slightly modified to meet the requirement of the large skin-miller, which has a work table measuring 30 ft. by 8 ft. This Cincinnati machine has been specially designed to meet the requirements of the U.S. aircraft industry, and is controlled entirely by information on punched cards. Procedure adopted for compiling the punched card data depends upon the complexity of the operation to be carried out. For the smaller and simpler parts, a desk calculator can be employed, but a computer is a valuable aid for more complex operations.

The two 100-h.p. cutter heads of the machine can be operated in unison, with the direction of motion reversed on one axis, or independently. Limits as small as $\pm 0{\cdot}002$ in. are well within the capabilities of the control equipment. With the conventional method of producing contoured parts on these machines, a copy-tracing system is employed with a 1:1 ratio template supported adjacent to the tool. The cost of such a system, together with the large template table needed for a skin-milling machine, it is stated, is often as high, or higher, than that of the electronic data control system.

PRODUCTION OF DOMESTIC REFRIGERATORS—During March of this year, the total value of domestic refrigerators produced in the U.K. was £1,727,000, and refrigerators to the value of £810,000 were exported. For the month of March, 1957, the corresponding figures were £1,280,000 and £693,000, and the average monthly values of refrigerators produced and exported for the whole year 1957, were £1,461,000 and £682,000.

The Use of Metal-reinforced Plastics for Dies

The Bakelite Co., Division of the Union Carbide Corporation, have recently introduced a new metal-reinforced plastics known as Epoxy-Alloy, and it is claimed that dies made from this material have a longer working life than has hitherto been obtainable. This material consists of an epoxy mass which is reinforced with fibres of steel or aluminium, or a combination of glass and steel. As an example of the results that are being obtained, it may be noted that the Epoxy-Alloy punch shown in the foreground in Fig. 1 has produced more than 130,000 motor car radiator tank tops, from 0·025-in. thick brass sheet, and is still in service. This tool, which is employed at the works of the Long Manufacturing Division, Borg-Warner Corporation, Detroit, Michigan, U.S.A., is approximately 4 in. wide by 23 in. long, and the depth of draw is 3 in. The die has a steel trimming flange, a metal insert for forming the filler neck, and a steel drawing surface, but all the contoured surfaces are formed from Epoxy-Alloy. It is stated that even after the number of operations quoted above, there was no indication of the filler insert becoming loose in the plastics.

Fig. 2. This Steel Die is Used to Produce Bottom Panels for Refrigerators and has Metal-fibre Reinforced Inserts to Form the Hump-shaped Cavity in the Stamping

Fig. 1. The Punch Seen in the Foreground is of Epoxy-Alloy, with Steel Inserts. It is Used to Produce the Motor Car Radiator Tank Top which is Being Inspected in the Background

A steel die, seen in Fig. 2, is employed by the Hotpoint Co., Chicago, to produce refrigerator panels from 0·035-in. thick, cold-rolled, steel sheet. The panel is fitted in the base of the refrigerator, and incorporates a hump-shaped cavity measuring 8 by 16 by 5¾ in., to clear the compressor unit. Inserts required to form this cavity were made from Epoxy-Alloy, and the complete die was made in a production time of five weeks. It was estimated that approximately twice that period would have been necessary had an all-steel die

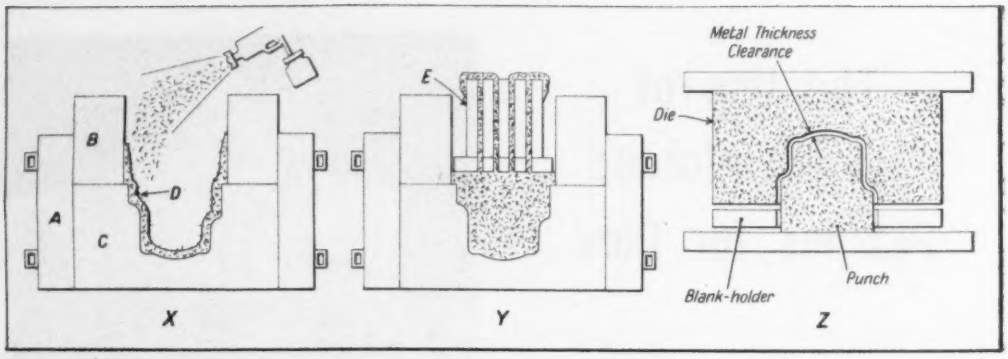

Fig. 3. Various Stages in the Production of a Metal-fibre Reinforced Epoxy Resin Punch and Die Set. *X*—A Face-coat of Short Steel Fibres is First Applied to the Mould. *Y*—A Hard Wood Punch, with Venting Holes, is Used to Compress the Charge of Resin and Dry Metal Fibres. *Z*—The Assembled Die Set. The Die has been Made in a Similar Manner to the Punch, Using Latter as a Pattern

been used. This tool has produced 65,000 refrigerator panels to date, and so far no repairs have been required.

As an indication of the economies which can be effected by the use of reinforced plastics for tooling, it is stated that 35 Epoxy-Alloy dies were produced in a time of 15 weeks, at a total cost of 250,000 dollars, as compared with an estimated time of 18 months, and a cost of 2,000,000 dollars, for conventional all-metal tools. One of these tools was required for drawing operations on aircraft parts, made from $\frac{3}{16}$-in. thick stainless-steel.

PRODUCING REINFORCED PLASTICS DIES

Although the procedure for making metal-fibre reinforced plastics dies is basically simple, it differs in several respects from the standard casting methods which are in current use. Initially, a hemp-reinforced plaster mould is produced, by means of a model of the tool which is required. To facilitate this process, the model is placed on a surface plate and a temporary wood fence is erected in order to retain the plaster. A typical plaster mould is indicated at *C* in the view at *X*, Fig. 3. Next, a wood (or steel) box is constructed around the mould, as shown at *A*, also an extension frame, *B*. A parting-coat is then applied to the internal surface of the mould, followed by the application of a face-coat *D*. This coat is a layer of heat-resistant epoxy resin, from $\frac{1}{16}$ to $\frac{1}{8}$ in. thick, which can be applied by means of a brush. Next, the surface of this face coat is "flocked" with short steel fibres, approximately $\frac{1}{16}$ to $\frac{1}{4}$-in. long, and the material is then allowed to become tacky. In the case of a small die, these steel fibres can be applied by means of a spray gun, as shown in the figure, but for larger dies, the use of a specially-designed metal-fibre flocking unit is recommended.

A weighed and mixed charge of resin is subsequently loaded into the mould, followed by a weighed quantity of dry metal fibres. Approximately 55 to 60 per cent steel fibre content is required. The metal fibres must be evenly distributed over the contours of the mould, in order to ensure a uniform density, since they do not move during the subsequent compressing process. Fibres from $\frac{3}{4}$ to 2 in. long have been found to be most suitable. Metal fibres in the form of shavings produced by the conventional steel-wool process are commercially available, and generally have a triangular cross-section, with sharp edges. These fibres are graded according to size, and have cross-sections ranging from 0·0018 to 0.008 in. In general, an increase in the coarseness of the fibres used results in a slight improvement in the physical properties of the mixture. Grade 1, however, has been most widely employed, so far, in preference to coarser grades, because it enables low porosity to be achieved, with better resin and fibre distribution.

The mould extension, *B*, is arranged to be three or four times as deep as the required casting, in order to accommodate the bulk of the fibres. A hardwood plug is placed on top of the charge of fibres, to form what is in effect a closed-mould system, and the complete unit is placed in a hydraulic press, or beneath a suitable hydraulic ram. This plug is shown at *E* in the view *Y*, Fig. 3, and is provided with a number of vertical vent holes for the escape of excess resin. The plug

is forced down by an applied pressure of the order of 200 to 300 lb. per sq. in., and this pressure is maintained for a period of between 4 to 12 hours, until the casting hardens. The part is then post-cured, at a temperature ranging up to 300 deg. F., the time required for this operation being determined by the size of the tool. Subsequently, the punch is used to make a mould for producing the die, with a suitable allowance for the thickness of the part or metal. The view at Z, Fig. 3, shows the reinforced plastics tools assembled as a conventional die set.

When chopped glass fibres are used as the reinforcing medium, the height of the extension box *B* requires to be only one half of the depth of the casting, as the bulk factor of such fibres is lower than that of steel. Glass fibres, however, must be pre-saturated, under pressure, with an equal weight of resin before they are loaded into the mould. A solid plug is employed in place of the vented type described above, and the compression cycle is carried out at a pressure of 50 to 150 lb. per sq. in. The curing process is the same as that employed for steel-fibre reinforced plastics. A dense, pre-impregnated steel-fibre mat, from ⅛- to ¼-in. thick, is applied to the face-coat, to provide additional reinforcement, and a similar mat, from ½- to 1-in. thick, can be used to back-up the tool and provide a more machinable surface.

In developing these reinforced plastics materials, a number of experiments were carried out with a series of terminal-box draw dies which were made from various materials. These terminal boxes, which were required for an electric motor, were 4-in. square, and were made from 7½-in. diameter blanks of 20-gauge (0·036-in.) cold-rolled steel. The draw was made over a 0·109-in. radius to a depth of 1¾ to 2⅜ in. One of the dies which was used is shown in Fig. 4, also a formed terminal box and a blank standing at the right. In all the tests, a steel blank holder was used, and the die was mounted (inverted) in a 93-ton capacity crank press, which had operating speeds ranging from 600 to 1,000 strokes per hour. Owing to the depth of the draw and the speed of operation, considerable heat was generated during stamping, and the temperature of the parts was of the order of 140 deg. F., or more, and of the dies, 115 to 144 deg. F. The latter temperature was measured at a distance of 0·050 in. from the draw-radius surface, at each corner. This combination of high operating speed and temperature accentuated the wear and breaking-down of the tool materials employed in the tests, and permitted a rapid evaluation of the various compositions.

The results obtained from the use of iron-core dies with a surface of room-temperature epoxy resin were unsatisfactory, as considerable wear and galling occurred. With glass-fibre reinforced, pressure-cast dies, a considerable improvement in performance was achieved by changing from polyester to heat-resistant epoxy. However, there was considerable ridging of the die surface and uneven wear, due to abrasion by the glass fibres, which, in turn, gave rise to wrinkles in the work-piece. The surface wear of heat-resistant, glass-fibre-reinforced dies was reduced by the application of an iron-powder face-coat, but the wear which did occur was still slightly uneven. Furthermore, difficulty was encountered in applying this face-coat, and ensuring that it adhered to the contours. A heat-resistant, epoxy casting, reinforced with glass-fibres, and with a face-coat which was

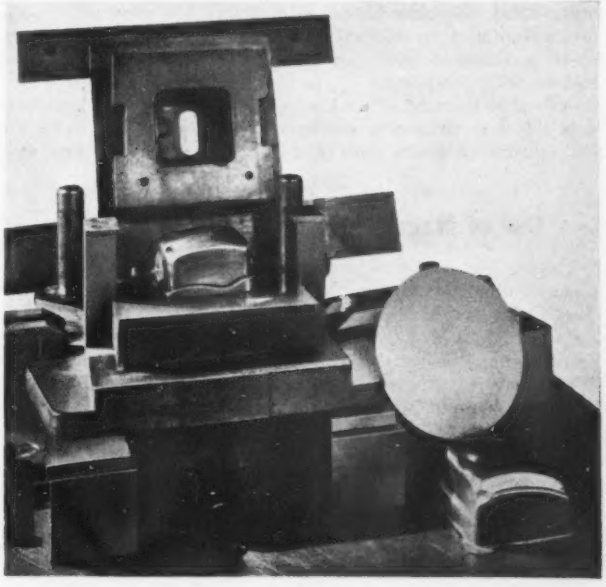

Fig. 4. The Die Set here shown is One of a Series which was Used to Carry out Tests on Tools Made from Different Compositions. A Formed Workpiece and a Blank are Seen at the Right

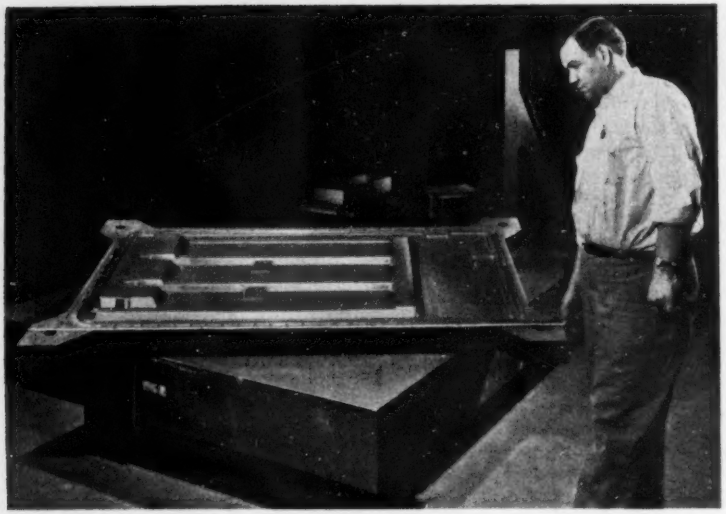

Fig. 5. A Heated Matched Mould Made from Aluminium-fibre Reinforced Epoxy-Alloy. The Cost of the Equivalent Tool in Steel would have been Three to Five Times as Great

flocked with steel-fibres, showed uniform wear and dimensional stability, and it was found that the face-coat could be applied easily.

Excellent results were also obtained by the use of heat-resistant epoxy dies which were reinforced with steel fibres and incorporated a steel-fibre flocked face coat. These dies are more easily machined than the glass-fibre type, and repairs and modifications can be effected readily. On the other hand, the glass-fibre reinforcement has certain advantages, in that simpler equipment can be used, and dies of large and complex form can be more readily produced.

Although the cost of an Epoxy-Alloy die is considerably less than of a similar tool in steel, it is still greater than the cost of a simple casting of compounded epoxy resin. Consequently, reinforced epoxy will be used only in those instances where its particular properties render it most suitable for specific operations. In addition to its applications for prototype, and for low- and medium-quantity production drawing work, this material can be used for dies for flanging; trimming; re-striking and second operations; rubber-pad forming and stretching; also for fixtures and gauges.

Epoxy-Alloy reinforced with aluminium fibres, which have a high thermal conductivity, can be used for the production of heated, matched moulds; vacuum-forming moulds; slush-moulding dies; and foundry patterns. An example of an aluminium-fibre reinforced Epoxy-Alloy heated, matched mould is shown in Fig. 5. It was estimated that this mould was made for one half the cost of an equivalent aluminium tool, and between one third and one fifth of the cost of a similar tool had steel been employed.

Use of Magnesium for Tooling

During the course of a paper presented at the recent annual meeting of the American Society of Tool Engineers, Mr. K. F. Melde drew attention to the advantages of magnesium in various forms as a constructional material for aircraft assembly jigs. Where fixture parts overhang, for example, rigidity can be obtained with substantial reductions in weight, so that a lighter and less expensive supporting structure can be employed. The lightness of magnesium may also be of great advantage where work locating units must be positioned and removed by hand. In addition the storage of jigs and fixtures is facilitated. It has also proved possible, in some instances, to employ the flat surfaces of magnesium plates, as delivered, for reference planes in jigs.

Magnesium dies for forming aluminium and aluminium alloys have also given good results. In this connection it is stated that the metal has good wear resistance and non-galling properties, and is "almost self-lubricating against aluminium." Economies are also obtained by reason of the ease with which magnesium can be machined.

Other characteristics of the material have been turned to account in welding jigs. Weld spatter does not adhere to magnesium and local heating causes little warping owing to the high heat conductivity. Magnesium being non-magnetic, moreover, there is no interference when it is employed in the construction of spot welding fixtures.

Flow-turned Nose Cone for Satellite

Nose cones for the U.S. Army Explorer satellites have been made by the Lodge & Shipley Co., Cincinnati, Ohio, to the order of the U.S. Army Ballistic Missile Agency and the Jet Propulsion Laboratory. Of 430 stainless steel, the cone is 12 in. long and has a maximum diameter of 6 in. The thickness of metal ranges from 0·094 in. at the centre of the nose to 0·013/0·017 in. for the conical walls, and the finished cone weighs 13 oz. Sixteen equally-spaced holes of ¼ in. diameter are drilled round the base to provide for attachment to the body of the satellite.

The cone was produced from an 8-in. by 0·094-in. thick blank which was first dimpled, as seen at *A* in Fig. 1, to provide for location on a mandrel. At the first flow-turning operation, the cone was brought to the form indicated at *B*, and after surplus material had been trimmed from the open end, the shape seen at *C* was obtained by spinning. A second flow-turning operation was then carried out, to produce the cone *D*, and, finally, the open end was again trimmed.

A vernier height gauge was employed for length checking during the forming stages, and the wall thickness of the initial cone was measured with a ball micrometer. Final wall-thickness inspection was carried out with a Branson Vidigage ultrasonic resonance gauge, as seen in Fig. 2.

Fig. 2. A Branson Vidigage Ultrasonic Resonance Gauge was Employed for Checking the Wall Thickness of the Finished Cone, which is Held to Limits of 0·013/0·017 in.

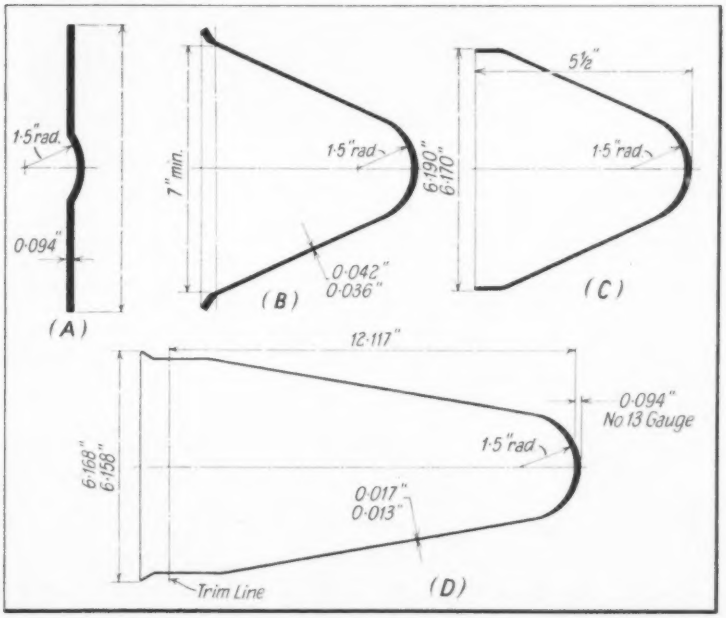

Fig. 1. Stages in the Production of the Satellite Nose Cone by Flow-turning and Spinning. An Initial Dimpling Operation Facilitates Location of the Blank on the Mandrel

STEEL PRODUCTION IN THE U.S.A., from January to March averaged 5·42 million tons per month, as compared with 8·39 million for the full year 1957, and 8·57 million tons in 1956.

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Automatic Production of Ball Bearing Rings

In Fig. 1 is shown the arrangement of a fully-automatic installation, comprising a Centex 4-spindle bar automatic and three Magdeburg second operation lathes, which was demonstrated at the recent Leipzig Fair, and provides for parting off ball bearing outer rings from tube, chamfering each side, and forming the raceway, in a cycle time of 6 sec.

Gravity feed channels, which also provide storage capacity to ensure a continuous supply of workpieces, link the four machines as seen in Fig. 2. From the automatic, the parted-off blanks are delivered down an inclined chute into a vertical channel, in the base of which there is a motor-driven, reciprocating lifter mechanism, whereby the parts are raised progressively. At the top, the vertical channel is of an inverted U-form, and open ended, so that the blanks fall into the top run of a inclined channel leading to the loading mechanism of the first Magdeburg lathe. Similar transfer arrangements are provided between the other second operation lathes, and the finished parts are automatically delivered to a marking

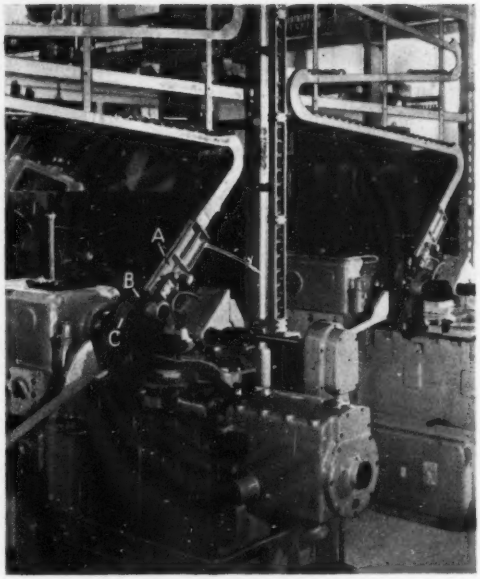

Fig. 2. View of Part of the Automatic Installation for Producing Ball Bearing Rings

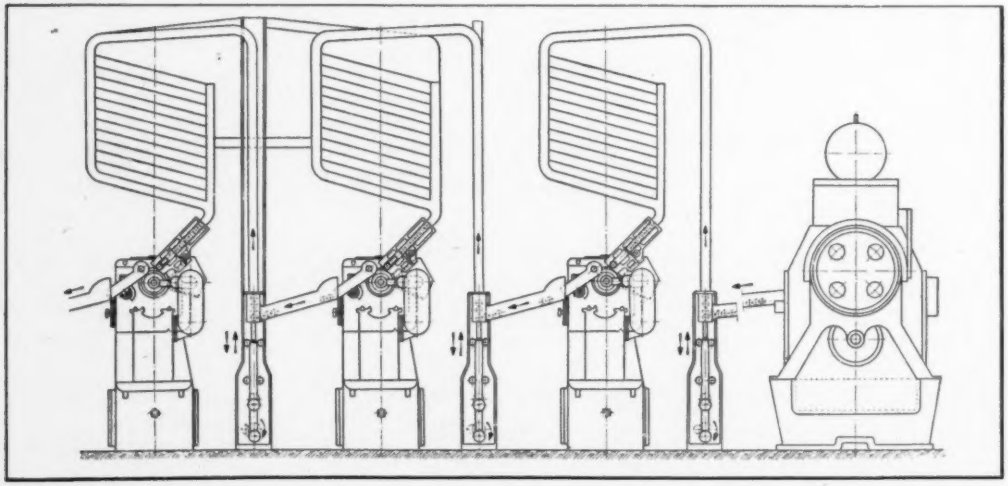

Fig. 1 (below). Arrangement of the 4-spindle Automatic and Three Magdeburg Second-operation Lathes for the Production of Ball Bearing Rings

press, on which the code number is stamped on the side face.

On the automatic second operation lathes, collets are employed for gripping the work by the periphery. Referring to Fig. 2, where the second Magdeburg lathe is seen in the foreground, the parts move down the feed channel to a release mechanism at *A*, and when a pivoted detent is withdrawn, each, in turn, is allowed to move forward to a pick-up station. An arm *B*, fitted with an expanding stub mandrel, is then advanced, by means of a cam, to pick-up the piece by the bore. Next, the arm retracts, swings down, and then moves towards the headstock again, to load the piece into the collet. At the end of the cutting cycle, the finished workpiece is removed from the collet by a rear ejector, and falls into a pivoted delivery chute, seen in the raised position at *C*, clear of the collet. The 4-spindle automatic runs continuously, and the operating sequence for loading, machining and unloading the parts on the Magdeburg lathes is controlled electrically by limit switches.

Fig. 3 shows the machining stages on the bar automatic and the three lathes. On the automatic, a length of tube sufficient for two rings is fed out at each cycle, and at the first station the bore is rough machined, and cross-slide tools are applied to face the end and form grooves in preparation for parting-off. Rough boring is continued, and the outside diameter is turned, at the second station, and at the third, the bore is finished machined and one ring is parted off. Finally, at the fourth station, finish boring of the second ring is completed, and tools on the cross-slide face and part off the second ring.

On the first Magdeburg lathe, chamfers are machined at the outer and inner corners at one side of the ring, and the latter is reversed, during its movement to the second lathe, so that the chamfers on the opposite side are turned at the next stage. The third lathe is set up for machining the ball track in the bore of the ring.

HYDRAULIC COPYING LATHE WITH FRONT AND REAR SLIDES

Other new developments by Magdeburg include an automatic multi-tool lathe, designated type DV250, which has a turning capacity of 10 in. diameter and is driven by a motor of 30 h.p., also a hydraulic copying lathe fitted with front and rear slides, which can be operated independently. This machine, known as the type DXHKD32, is seen in Fig. 4, set up for profile turning steel hubs for motor cycle rear wheels. By using the two copying slides, the profile can be finish turned at both ends of the workpiece during the one cycle.

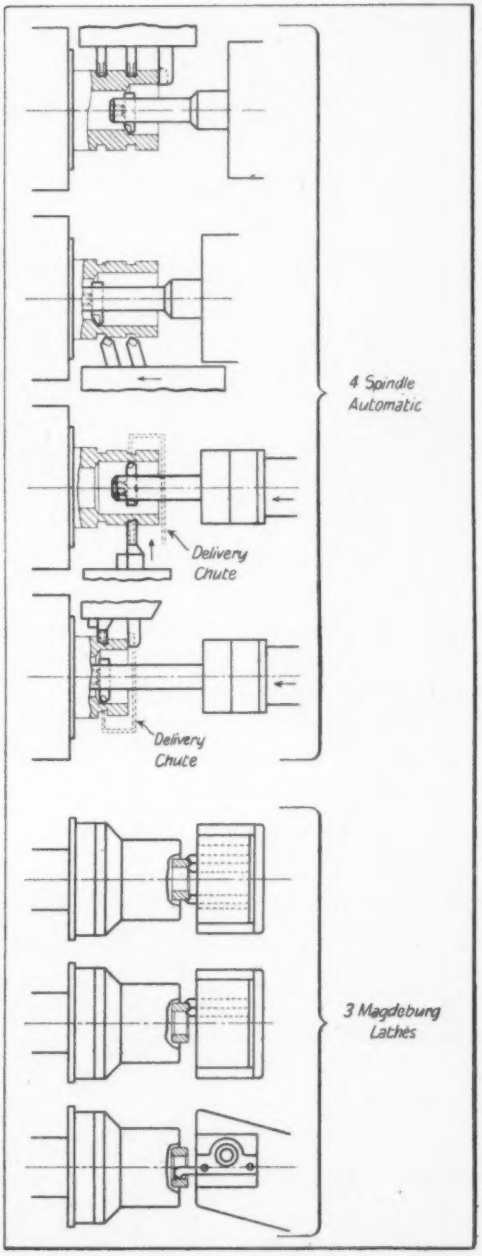

Fig. 3. Operation Layout for Machining Ball Bearing Rings from Tube

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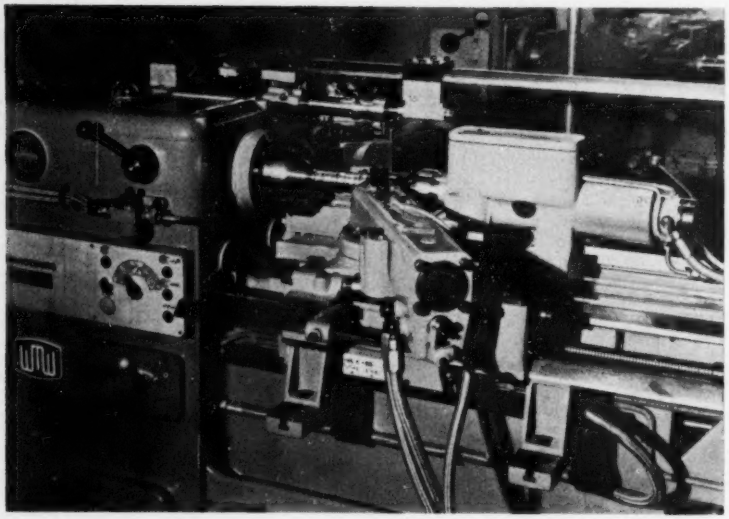


Fig. 4. Magdeburg Type DXHKD32 Copying Lathe which is Fitted with Front and Rear Tool-slides

The swing capacity of this lathe is 6½ in. diameter over the carriage, and 12½ in. diameter over the bed, and workpieces up to 20 in. long are admitted between centres. There are eight spindle speeds, from 250 to as high as 2,800 r.p.m., and nine rates of carriage feed from 0·0025 to 0·040 in. per rev., the traversing motion being effected by screw. Rapid traverse at the rate of 14 ft. per min. is provided, and the maximum stroke of the copying slides is 2⅜ in. Either a hydraulically- or a pneumatically-operated tailstock assembly can be fitted.

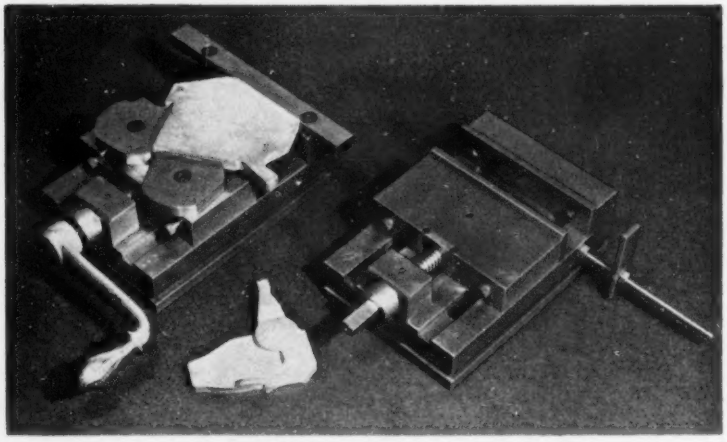
Magdeburg lathes are handled in this country by Hicks Machinery, Ltd., 26 Addison Place, London, W.11.

Multi-purpose Vices

By W. RAWLES

The machine vice seen at the right in the accompanying illustration weighs only 34 lb., and has an opening of 2⅜ in. between parallel jaws. Slots machined on all four sides of the base enable the vice to be clamped to the machine table in almost any angular position in the horizontal plane. Owing to the absence of lugs on the vice, the clamp bolts do not interfere with the work or cutter. An adjustable stop at one side, facilitates cutting materials to length.

A similar vice, seen at the left, has tapped holes in the top surfaces of the jaw supports, whereby steel parallels can be mounted to take work up to 5 in. wide. In addition, the sliding jaw member has T-slots to enable gripping members of suitable shapes to be fitted for holding workpieces with irregularly-shaped profiles.



(Right) Machine Vice with Slotted Base and End Stop. (Left) Vice Equipped with a Parallel and Special Gripping Members for Holding Parts of Irregular Shape

Wiedemann Fine Boring Machines

The fine boring machines of unit construction built by Wiedemann K.G., Düsseldorf, Germany, are available in vertical and horizontal designs of different sizes, and with single and multiple spindles.

Mounted on flat guideways, the boring heads are driven by pole-changing motors through V-belts and stepped pulleys. This arrangement gives a total of 6 spindle speeds, and the nitrided steel spindles run in sleeve-type bronze bearings, which can be adjusted for wear. Cutting feed is applied to the boring head by mechanical means, and 6 different rates, usually from 0·0016 to 0·0032 in. per rev., can be obtained by pick-off gears. Alternatively, other feed ranges can be provided to suit requirements. The machines are designed for operation on an electro-mechanically controlled automatic cycle, during which the boring head is rapidly traversed towards the work, the spindle drive is engaged, the feed is applied, the spindle is stopped, and the head is rapidly returned.

The type EF22GV horizontal machine shown in Fig. 1 incorporates two spindle heads which are mounted at opposite sides of the central work-holding fixture, and are off-set in relation to each other to permit of boring closely-spaced holes. It is here shown set-up for fine boring, at a single setting of the work, the crank and gudgeon pin bearing holes of connecting rods to close tolerances for diameter and centre distance. Spindle speeds up to 3,000 r.p.m. can be provided, and the stroke of the boring head is 10¾ in. The distance from the surface of the table to the centre of the tool spindles is 8 in., and the spindles can be spaced at centre distances up to 6 in. A working surface of 12 by 28 in. is provided on the table.

Fig. 2. Wiedemann Type EF212 2-spindle Single-ended Fine Borer

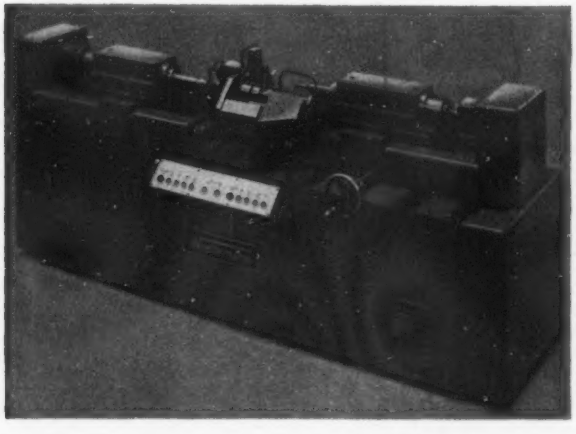


Fig. 1. Wiedemann Type EF22GV 2-spindle Horizontal Fine Borer

In Fig. 2 is shown a single-ended 2-spindle machine, known as the type EF 212, equipped with spindle heads of the same type, which enables fine boring to be carried out on bores with centre distances ranging from 5 to 10 in. The working surface of the T-slotted table is 24 by 18 in. A similar machine, designated type EF22V, is available which permits holes with centre distances from 8 to 25 in. to be bored.

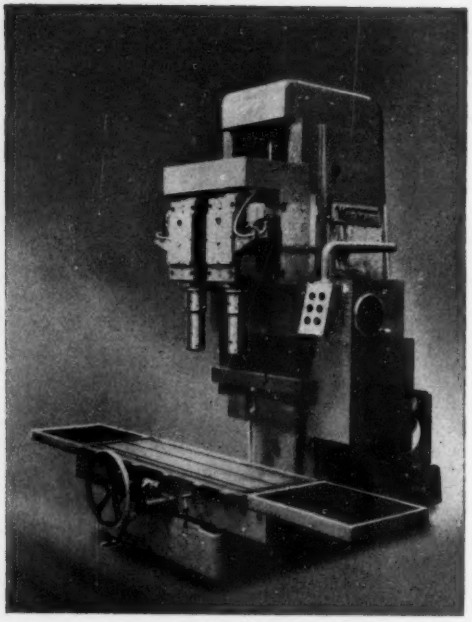


Fig. 3. An example from the Wiedemann Range of Vertical-spindle Fine Boring Machines

The range also includes a type EF21 horizontal single-spindle fine borer, with an 18½- by 10¼-in. T-slotted work table, which can be adjusted 8⅝ in. horizontally and 10⅝ in. vertically, by hand. A dial indicator is fitted for use in conjunction with slip gauges to facilitate accurate table setting.

Intended primarily for boring the larger diameter holes, and for handling parts such as motor-car cylinder blocks, the vertical machines are available in three sizes with a maximum of six boring spindles, which can be adjusted for centre distance. One of the vertical machines—the type ZB8002V—fitted with two spindle heads for fine boring cylinder blocks, is illustrated in Fig. 3. The stroke of the boring slide is 34 in. and the centre distance of the spindles is adjustable from 8 to 16 in. Spindle speeds from 75 to 750 are provided, and the 55- by 20-in. work table has a travel of 39½ in. longitudinally and 4 in. transversely.

Different ranges of steplessly-variable spindle speeds can be provided to suit requirements, and since the machines are intended for long production runs, there is normally only one feed rate. If required, pick-off gearing may be incorporated in the drive to enable the feed to be changed.

Elgar Machine Tool Co., Ltd., 172-178 Victoria Road, Acton, London, W.3, who are the agents in this country for Wiedemann fine borers, inform us that a vertical 2-spindle machine was recently installed in the works of the Caterpillar Tractor Co., Ltd., Glasgow.

Trade Publications

LINCOLN ELECTRIC CO., LTD., Welwyn Garden City, Herts.—Leaflet describing the new LR.150 SAE. 150-amp. portable welding unit, which has been specially designed to be used with, and driven by, a Land Rover vehicle.

J. COLLIS & SONS, LTD., Regent Square, Gray's Inn Road, London, W.C.1. Lists No. 306, 307, and 308, covering the company's range of pallet type trucks, Mota-Veyors and conveyors.

PRECISION COMPONENTS (BARNET), LTD., 13 Byng Road, Barnet, Herts. Leaflet describing the Kabi 2B.A. and O.B.A., types U.30 and U.60, unit terminal blocks. The U.30 type is moulded in 4-way units, and the U.60 in single units, the latter being suitable for building-up as multi-way banks on steel channel-section bearers.

EQUIPMENT & SERVICES, LTD., The Fairway, Bush Fair, Harlow New Town, Essex.—Leaflet describing the type TBT unit, recently introduced by the company, which provides for automatic timing of tea break periods. Operation can be initiated by pressing a start push button or by an electrical impulse from external contacts. A circuit, usually to a bell, is closed for 5 sec. An interval of 10 min. then elapses, after thich the circuit is again closed for 5 sec.

ALEXANDER DUCKHAM & CO., LTD., Hammersmith, London, W.6. Booklet entitled Progress in Lubrication, which reviews the company's technical developments and activities during the past few years. A section is devoted to the laboratory wherein radioactive materials are used to carry out research connected with the wear of cutting tools. Other items of interest include the development of a multi-grade motor oil, grinding fluids, press and drawing compounds and preservatives.

ADDISON ELECTRIC CO., LTD., 10/12 Bosworth Road, London, W.10.—Illustrated leaflet No. W2.58, describing the types 440M and 440A equipment for pre-heating wire which is to be insulated by means of extruded PVC, polythene, or foam rubber, for example. The wire is heated by passing an electric current through a short section as it is fed continuously between special contact rollers which are provided with carbon contact brushes. Reference is also made to the type 425 portable wire temperature indicator.

CUXSON, GERRARD & CO., LTD., Fountain Lane, Oldbury, Birmingham. Fully-illustrated catalogue No. 44 entitled "First Aid Requisites." The first part of this catalogue is devoted to industrial first aid regulations, and incorporates the relevant paragraphs from the Factories Act, 1937. Details are given of the first aid requirements for various industries, and the remainder of the catalogue, which extends to a total of 165 pp., is devoted to a description of the very wide range of first aid products offered by this company.

News of the Industry

Manchester and District

REDUCED DEMAND FOR PIG-IRON.—The cautious buying policy as regards all grades of pig-iron still prevails in the Lancashire area and there are no signs of an expansion in demand at present. With many foundries operating below capacity, and with the various grades of pig-iron readily available for despatch from the Derbyshire and Staffordshire blast furnaces, there is little incentive for consumers to place forward contracts. A fairly steady call for haematite pig-iron is reported, also for the various grades of finished iron materials, and quotations are maintained at the recent levels.

RESTRICTED BUYING OF STEEL.—There is a steadily maintained pressure for deliveries of heavy steel plates and the larger diameter mild steel bars, but sections of the steel trade would welcome new business. Rollers of both light and heavy structural steel materials are affected by the current slackening of demand. Semi-finished materials for the local wire-drawing industry and forges are moving fairly steadily, but in all directions confidence in an early return to busier conditions appears to be lacking. As the annual holiday season approaches there is a general feeling that any upward trend in consumption will be delayed until the autumn.

MATTERSON, LTD., Shawclough, Rochdale, report a good demand for electric hoists and overhead electric travelling cranes, with lifting capacities from 1 to 10 tons, and spans up to 67 ft. Our attention was drawn to the new designs of electric hoist blocks of 1- and 3-ton capacities, which are built in both standard and low headroom types, and we hope to make further reference to them in due course. Another innovation is a 10-ton crab of monobloc construction. A repeat order has recently been received from the National Coal Board for a special hoist winch, and we noted, nearing completion, 14 one-ton air-operated cranes for use on board ship for cargo handling.

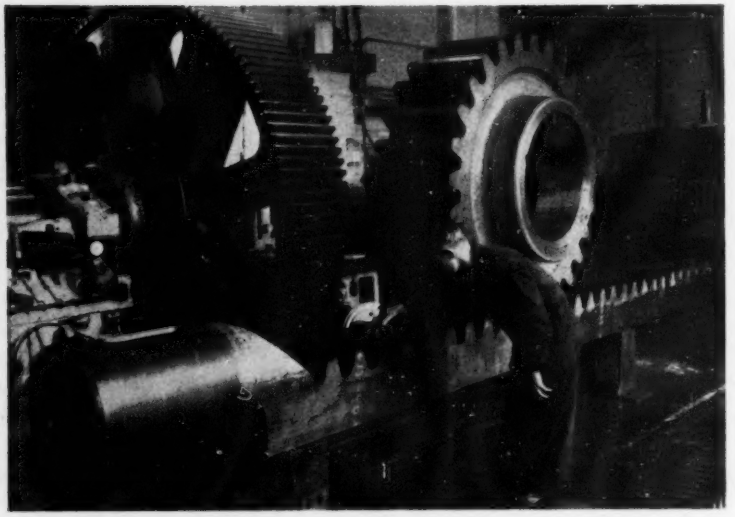
The machine tool and gearbox section is experiencing a continued demand for the No. 11 and No. 12 thread milling machines, which are marketed by Dowding & Doll, Ltd., 346 Kensington High Street, London, W.14, and for spur and bevel gear cutting attachments for use on shaping machines. Gearbox orders cover standard 2-, 3-, and 6-speed types, as well as special units. Among the latter, we noted, in course of development, a 24-speed gearbox to give speeds in arithmetical progression. For transmitting 10 and 30 h.p., the units will have input speeds of 1,000 r.p.m. The latest addition to plant at these works is an Asquith 5-ft. O.D.1 radial drilling machine.

ORMEROD ENGINEERS, LTD., Shawclough, Rochdale, are experiencing a steady call for a variety of repetition machining work, which includes turning, thread milling, splining, and hobbing operations. Orders are also in hand for Shirley metering pumps for the textile and chemical industries, special control boxes, emulsifiers, and for a batch of 24-in. diameter wheel portable swing-frame grinders, of new design, which are being built under sub-contract for the Universal Grinding Wheel Co., Ltd., Stafford. The company's secretary, Mr. R. Drake, has recently been appointed general manager at these works.

BUTTERWORTH BRITISH AUTOMATIC MACHINE TOOL CO., LTD., Lincoln Street, Rochdale, are engaged on both home and export orders for bar automatics with capacities of 1⅝, 2 and 2½ in. diameter, including both mechanical and hydraulic-type machines. We may note recent export orders from India and Australia.

FROST (ROCHDALE), LTD., Crawford Street, Rochdale, report a steady home and export demand for their various types of sheet metal working machines. Orders in hand cover guillotine shearing machines ranging from treadle types up to 8 ft. by ¼ in. capacity; plate bending rolls up to 8 ft. by ⅜ in. capacity; and folding machines up to 8 ft. by ⅛ in. capacity.

JOHN HOLROYD & CO., LTD., Milnrow, Rochdale, are busy with a variety of gear-cutting work, and a wide range of types and sizes of worm gear reduction units, destined for all parts of the world. On the machine side we may note orders for worm wheel hobbing machines, rotor milling machines, a vertical spindle plano-milling machine for operations on aluminium slabs using inserted blade cutters, and woodworkers' tool grinding machines. On export account we may note recent orders from the U.S.A., Germany and Japan. Manesty tabletting machines are in brisk demand and the firm's Holfos bronze department is busy on centrifugal castings. Various additions have been made to the machine tool plant since our last visit.



Large David Brown Pinion and Rack for Tilting a 35-ton Basic Bessemer Steel Converter at the Corby Works of Stewarts & Lloyds, Ltd.

DAVID BROWN INDUSTRIES, LTD., JACKSON DIVISION, Salford, Manchester, have recently supplied the machine cut rack and pinion, shown in the accompanying illustration, for tilting a 35-ton basic Bessemer steel converter at the Corby (Northants) plant of Stewarts and Lloyds, Ltd. The pinion, which weighed 5¼ tons when finish machined, was cast and cut at the Salford works, and the 7¼-ton rack was cut from a solid forging. Operations on the latter component included boring and turning the spigot end, and machining a cotterway. The ladle trunnion will extend on one side to carry the pinion, and the rack will be driven hydraulically. H. B.

The South West

LLEWELLINS MACHINE CO., LTD., King's Square, Bristol, who were established here during the latter half of last century, are experiencing a regular demand for their watchmen's patrol clocks from firms and government departments in all parts of the world. A comprehensive plant for the production of all types of gears, with the exception of spiral bevel and double helical types, is installed in the works, including machines by Pfanter, Gleason and Fellows. Work undertaken ranges from fine pitch gears used in aircraft instruments to large spur gears up to 4 ft. diameter.

W. H. MILLIER & CO., LTD., 272 Southmead Road, Bristol, are well established in their new works to which they moved from nearby Kelston Road. The volume of orders is well maintained, and work in progress includes a wide range of gears, the production of which is the firm's principal activity. Among the machines installed for this purpose are Gleason bevel gear generators, Sykes hobbing machines, and Fellows gear shaping machines. Worms up to 10 in. diameter can be produced on a Lees-Bradner machine, which is provided with attachments for milling splines. This machine is used extensively for the production of lead screws, some of which exceed 12 ft. in length. The company is on the A.I.D. approved list for gear manufacture. A well-equipped machine shop in which are installed centre, turret and capstan lathes; internal, external and surface grinding machines; and Delapena honing equipment; is being kept fully occupied with work for a wide variety of industries.

RAY ENGINEERING CO., LTD., Southmead Road, Southmead, Bristol, are still busy with the production of an extensive range of moulded plastics handwheels and knobs, sold under the trade name Rencol, which are used by many makers of machine tools and workshop equipment. These products are made from phenolic resins and the yearly output is in excess of 1,000,000 items. In addition to these standard mouldings, special electrical fittings, of heavy current carrying capacity, are manufactured for marine applications. This company, which was founded 33 years ago, entered the field of plastics moulding five years later.

NEW FORTUNA MACHINE CO., LTD., Fortuna Works, Kelston Road, Southmead, Bristol, report a satisfactory demand for their skiving machines, hacksawing machines, and the recently introduced Limitax metal cutting bandsaw, which is now available in heavy-duty form and will cut bars up to 10 in. diameter and flats or sections up to 5 in.

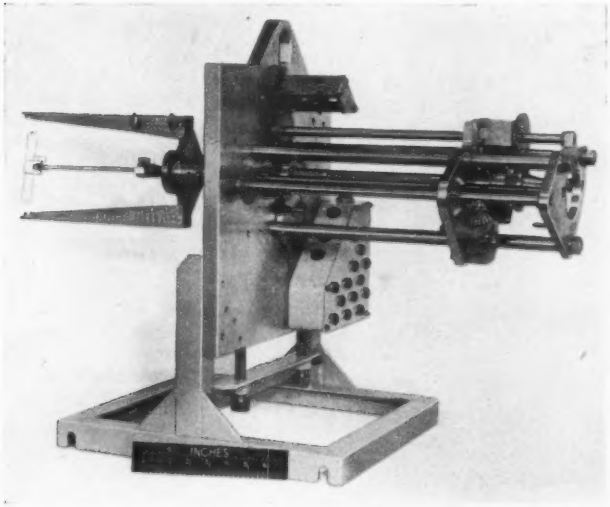
by 15 in. Notwithstanding keen foreign competition, it is stated, the company is maintaining its position in the export markets.

NAISH BROS. & CO., LTD., 124 Cheltenham Road, Bristol, are actively engaged in the design and construction of various types of press tools. The press shop, which forms part of this organization, is equipped with presses with capacities up to 100 tons, and some of these machines are set up for long run production.

A. & S. OSMOND, LTD., 13 Dowry Square, Bristol, 8, report a satisfactory demand for their extensive range of high-speed abrasive wheel cutting-off machines, the largest of which is fitted with a 30-h.p. electric motor. Development work on new machines is continually in progress and in this connection it may be noted that one of the smaller machines, fitted with a 3-h.p. motor, can now be provided with a swivel-head, to facilitate angular cutting of tubes and other sections. This firm's export order book remains satisfactory, and we understand that the demand from Canada for Osmond machines is well maintained, despite keen competition.

MOORE'S (BOURNEMOUTH) LTD., Wallisdown Road, Bournemouth, Hampshire, are busy with the manufacture of a wide range of engineering products, which includes vacuum and pressure vessels in stainless steel and light alloy for use in nuclear research. This firm has produced much specialized equipment required in connection with important atomic energy installations and the accompanying illustration shows a remote handling device, which was supplied for manipulating radio-active material. The forked head, on the left, can be rotated and tilted, as required, by the assembly of shafts and gears which passes through a shield made of stainless steel and brass. This apparatus is normally provided with an electric motor drive.

The works, which were completed two years ago, extend to 26,000 sq. ft. on a 3-acre site. Two Société Genevoise jig-boring machines, and a comprehensive range of other modern machine tools are installed. **F. W. H.**



Remote Handling Apparatus, made from Stainless Steel and Brass, for the Manipulation of Radio-active Material

New Films on Productivity

Three new films on productivity were recently shown at the National Film Theatre, London, S.E.1, by the British Productivity Council, 21 Tothill Street, Westminster, S.W.1.

"Method Study in the Office," is the title of the first, which illustrates how clerical procedures, no less than industrial processes, can benefit from method study. By case histories for small and large organizations, it is shown that with careful collation of all facts, and by studying, analysing, and questioning them, greater efficiency and increased output can be obtained. An interesting example is afforded by methods used at the premises of Ronson Products, Ltd., where typists and mechanics are arranged on opposite sides of a conveyor belt on which parts requiring repairs are carried. While the mechanics attend to the parts, the appropriate paper work is dealt with by the typists.

The second film is entitled "A Nation of Shopkeepers," and is concerned with the use of the simple techniques of method study to lower costs and to provide greater satisfaction to both customers and staff in an ironmonger's shop.

In the third film, on "Variety Reduction," the principles of the subject are briefly explained and it is shown how production costs may be lowered by discontinuing the manufacture of products in a firm's catalogue that contribute least to the sales income. The action of the film takes place in a managing director's office where the executive staff are gathered to discuss proposals of a consultant. Arguments for and against a policy of variety reduction are forcibly ex-

pressed, and its implications for the design, production, sales, and accounting departments are considered. The film should be of particular interest to those concerned with management techniques.

Copies of these films, in the 16-mm. size, can be purchased from the Council. Alternatively, they may be hired from the Central Film Library, Government Buildings, Bromyard Avenue, Acton, London, W.3.

Darwins Kingfield Works

The new Kingfield Works, Sheffield, of Darwins Bright Steels, Ltd., which were recently opened by The Rt. Hon. Lord Riverdale, J.P., have enabled the company to concentrate all their wire producing plant under one roof, and more efficient operation is thus permitted. Comprising five bays, each 112 ft. 6 in. long by 45 ft. wide, the wire mill has a floor area of 28,000 sq. ft., and there are additional buildings, for example, for stocking wire coils and for inspection.

Plant in the heat treatment bay includes the spheroidizing furnace shown in Fig. 1, which was supplied by the Electric Resistance Furnace Co., Ltd. Of the vertical, cylindrical, forced air circulation type, this furnace is rated at 350 kW. and provides a maximum temperature of 800 deg. C. In addition, there are pit pot type vertical annealing furnaces by the above company and by Junkers.

The second bay is devoted to cleaning or descaling wire and wire rod coils after treatment, and the third to wire drawing. In the latter, the equipment comprises Farmer Norton 9-hole and 4-hole wire drawing machines; a 26-in. hot wire drawing block which is driven through a Heenan & Froude coupling and has stepless speed variation from 50 to 200 ft. per min.; and eight single wire drawing blocks.

In the fourth bay there is a Crossley 8-block, wire drawing machine, and the Schumag combined drawing machine shown in Fig. 2. This machine is employed for drawing, cutting, straightening, and polishing rounds, also for drawing, cutting, and straightening squares and hexagons. The maximum pull is 6,600 lb.

Fig. 2. A View in No. 4 Bay, Showing the Schumag Machine for Drawing, Cutting, Straightening and Polishing

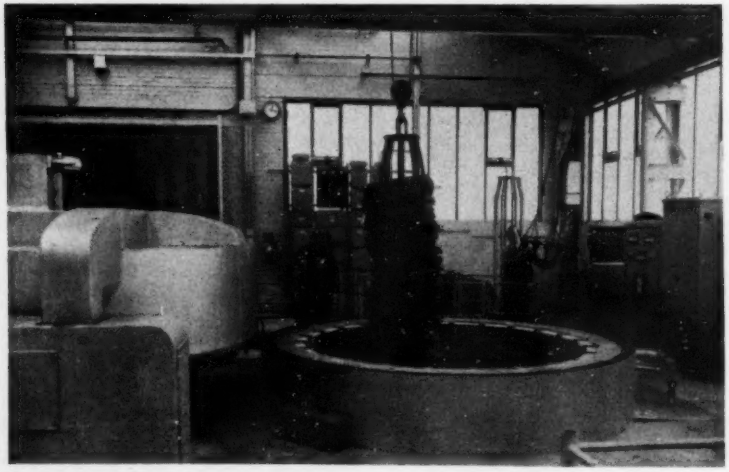


Fig. 1. The Spheroidizing Furnace (Electric Resistance Furnace Co., Ltd.) Installed in the Heat-treatment Bay at the Kingfield Works of Darwins Bright Steels, Ltd.

No. 5 bay is concerned with finishing and dispatch, and among the equipment in this section may be noted a Wafios automatic wire straightening and cutting-off machine with flying shear; a Robertson reeling machine; a Schumag centreless grinding and polishing machine; Scrivener and Lidköping centreless grinding machines; Speedax and Ballinger abrasive cutting-off machines; and a Canning wire polishing machine.

Determining the Effects of Mechanization on Production Costs

(*Continued from page* 63)

struction of machines, to adaptability whereby obsolescence may be deferred, to preventive maintenance, and to effective utilization. It is also suggested that accurate breakdowns will draw attention to the material constituents of unit costs, and stimulate investigations of alternatives, different product designs, and more economical processing methods.

Realization of all these benefits, however, will depend upon the development and application of more detailed accounting procedures than are now commonly employed.

Obituary

MR. HUGO FRYE.—It is with regret that we record the recent death of Mr. Hugo Frye at the age of 79. In 1904 he established the business which was subsequently formed into a limited liability company in 1921, under the title of B. Elliott & Co., Ltd., and held the position of chairman for more than 50 years. He relinquished this office to his son, Mr. Jack Frye, some three years ago, but remained a member of the board and continued to take an active part in the direction of this and the associated companies until the time of his death.

B. Elliott & Co. were originally concerned primarily with the importation of American and Continental machine tools and engineering equipment, but owing to Mr. Frye's foresight, machine tool production was begun in 1928, and this side of the business was actively pursued, with the result that by 1939 the machine building side represented a large percentage of the Elliott business.

On account of unsettled world conditions, the nucleus of the Victoria Machine Tool Co., Ltd., was formed in 1937. This business made substantial contribution to war-time machine tool requirements and has subsequently continued to expand. Two other manufacturing units have since been added to the Elliott Group—The Cardiff Lathe & Tool Works, Ltd., at Cardiff, and The Progress Drilling Machine Works, Ltd., at Maesteg, Glamorgan. In addition, machine tool building for the Group is undertaken by sub-contractors. Despite the expansion of the machine building side, Mr. Frye retained his interest in the machine tool import business, and in 1947 the Elgar Machine Tool Co., Ltd., was formed to take up agencies for machines that do not conflict with the Elliott range.

Mr. Hugo Frye

At the same time he was fully alive to the importance of exporting machine tools and was actively concerned with the establishment of a comprehensive sales organization which includes subsidiary companies in Canada, South Africa, and Australia.

By reason of his long association with machine tools, Mr. Frye was well known in the metal working industries where he had many friends.

Correction

In MACHINERY 93/48—2/7/58, reference was made to the activities of Rudolph Carne & Co., Ltd., and owing to a misprint the name of one of the milling machine makers represented by the company was wrongly given. The sentence in question should have read: "This firm has supplied many universal milling machines by Huron and Dufour . . ."

Industrial Notes

AUTOHOPS, LTD., inform us that their address is now Rear of Old Court House, London Road, Ascot, Berks.

E. J. JACK, LTD., 154 Camden High Street, London, N.W.1, inform us that they can supply the split-race ball bearings described in MACHINERY, 93/38—2/7/58.

ELGAR MACHINE TOOL CO., LTD., 172–178 Victoria Road, Acton, London, W.3, have been appointed sole distributors in the United Kingdom for the range of heavy duty bed-type milling machines and die sinking machines made by Droop & Rein, Bielefeld, Germany.

THE TIN RESEARCH INSTITUTE, Fraser Road, Greenford, Middlesex, have published the Summer issue of their quarterly journal "Tin and its Uses," in which may be noted articles concerned with the use of printed circuits for television sets, and the use of tin in atomic fuel elements.

AN AUCTION SALES OF MACHINE TOOLS, vehicle spares, and electrical and miscellaneous stores, from M.O.S. Sub-Depot, Lily Lane, Byley, Middlewich, Cheshire, will be held at New Islington Public Hall, Ancoats, Manchester, on July 29 and 30. The auctioneers will be J. H. Norris & Son (Dept. N.), 9 Albert Square, Manchester, 2.

DIMCO (GT. BRITAIN), LTD., are now operating from offices attached to the warehouse building which they have already occupied for some time at 28 Wood Lane, Shepherd's Bush, London, W.12, (telephone number Shepherd's Bush 4401.) The former Oxford Street office is being retained, but all correspondence and telephone calls should be directed to the new address.

TRIPLEX SAFETY GLASS CO., LTD., inform us that the name of the company has been changed to Triplex Holdings, Ltd., and that this latter company will, in future, control the investments in the subsidiary companies. These subsidiaries include, among others, Weldall & Assembly, Ltd., Stourbridge; Stern & Bell, Ltd., Birmingham; and Charles S. W. Grigg, Ltd., Hounslow, Middx.

B.A.C. BUSH PREDICTOR.—A useful "predictor" which has been introduced by British Aero Components, Ltd., Montague Road, Warwick, enables all the working dimensions of a bush (also its liner and locking screw, where appropriate) to be read off simultaneously through apertures, when a slider has been set to the bore size. The apertures are effectively associated with diagrams, and brief instructions are given.

STEEL, PEECH & TOZER, P.O. Box 90, The Ickles, Sheffield, 1, a branch of The United Steel Companies, Ltd., inform us that they are to install a cold-rolling mill, complete with ancillary equipment, adjacent to the continuous medium-width hot strip mill at their Brinsworth works. This new plant, which will cost £1¾ m., is scheduled to be in operation in two years' time.

ROTO-FINISH, LTD., Mark Road, Hemel Hempstead, Herts, have introduced a twelve months' maintenance agreement plan, whereby a trained service engineer will visit customers' factories once every four months to overhaul and maintain Roto-Finish equipment. This agreement will be available initially for factories in the main industrial areas. It is planned to extend the service to the whole of the United Kingdom in due course. The arrangement will be additional to a comprehensive free service, already afforded.

WINSTON ELECTRONICS, LTD., Shepperton, Middlesex, who have recently been appointed distributors in the United Kingdom for the products of Beckman Berkeley and Berkeley Helipot, Richmond, Calif., U.S.A., are to hold a series of demonstrations of the electronic equipment made by these companies. These demonstrations are for directors, scientists, engineers, and chief executives, and will be held at the company's works at Shepperton each day from July 15 to 18, inclusive, starting at 9.45 a.m. British, American, and German engineers will be in attendance to explain and demonstrate the equipment.

CROMPTON PARKINSON, LTD., Crompton House, Aldwych, London, W.C.2, report that they are organizing an electrical engineering exhibition to be held at the M.A.N.W.E.B. Industrial Showrooms, 83 Paradise Street, Liverpool 1, from July 14 to 19. Exhibits will include the complete range of Crompton fluorescent lighting equipment and trunking; a range of lamps; the new Modulume ceiling; and two new speed indicators. Several types of stud-welding equipment will be demonstrated, and there will be a wide range of electric motors on display, including types with series E insulation.

TIME RATES OF WAGES AND HOURS OF LABOUR.—The twelfth edition of this publication compiled by the Ministry of Labour and National Service, has recently been issued. The main tables show, for the majority of industries and occupations, the minimum or standard, time rates of wages, the dates from which these rates became operative, and the normal hours of labour.

Particulars are also given, where available, of the basic rates for pieceworkers, the additional rates payable to shift and night workers, and, where they are known to exist, of the arrangements for a guaranteed weekly wage or period of employment. Copies are obtainable from H.M. Stationery Office (price 15s., by post 15s. 9d.).

Babcock Education Centre

A new educational and training centre which has recently been opened, at the Renfrew works, of Babcock & Wilcox, Ltd., comprises a large administrative block and adjacent training workshops. Accommodation is provided for the teaching staff, and there is a lecture hall, with a seating capacity for 200 students, which is equipped with film, slide, and graphic projectors. The workshops, which can accommodate up to 150 trainees, are equipped with a variety of machine tools and other training equipment, and there is a smaller lecture room on these premises for talks on workshop practice.

Three categories of training are provided, namely, for trade apprentices (craft training); for student apprentices (whose studies lead to an engineering degree); and for graduate apprentices. The company's training scheme has been in operation on an increasing scale for more than 13 years, and there are now approximately 760 apprentices at Renfrew, at various stages of training.

Sir Alfred Herbert Scholarships

A trust fund was established in 1956 by members of The Machine Tool Trades Association as a tribute to the late Sir Alfred Herbert, K.B.E., the proceeds of which are devoted to travelling scholarships. The trustees may award more than one scholarship in any one year and they will be of the order of £60 for tours within the United Kingdom, or £90 for tours embracing any country or countries on the continent of Europe. The duration of the tour is intended to be approximately four weeks.

Successful applicants will be enabled to undertake a tour of the United Kingdom or the continent of Europe, with a view to expanding their knowledge of the design, production, or employment of machine tools.

Awards will be offered annually, and are open to past or present students of the Coventry Technical College who have been educated by regular attendance at that College to the standard of Higher National Certificate (in engineering), City and Guilds (Final), or have comparable qualifications. They must also have had practical training to a standard satisfactory to the trustees and, for 1959 scholarships, must be between the ages of 21 and 27 years on November 1, 1958.

Forms of application are available from the Principal of the Coventry Technical College and must be completed by November 1, 1958.

Personal

MR. J. S. CANNING has been appointed to the board of Ransomes, Sims & Jefferies, Ltd., Orwell Works, Ipswich, as a non-executive director.

MR. W. E. S. GILMOUR of 5 Western Way, Wellingborough, Northants, has been appointed a representative for William O. Bullock & Sons, Ltd., 126 Rodbourne Road, Swindon, Wilts., and will be responsible for the Eastern Area of England.

MR. WALTER W. JEACOCK, M.I.Prod.E., has been appointed general manager of Coventry Gauge & Tool Co., Ltd., Coventry, in succession to the late Mr. Arthur J. Hewitt, O.B.E. Mr. Jeacock, who is well known in the engineering industry, joined the company as an apprentice in 1921. He has held important administration appointments and became works manager in 1951. He is a member of the committee of the Coventry Section of the Institution of Production Engineers.

Mr. W. W. Jeacock

MR. G. BLEMMINGS, 78 Hill Lane, Blackley, Manchester, has been appointed representative for the North West Area, and MR. M. J. VIVIAN, 136 Northridge Way, Hemel Hempstead, Herts, and MR. D. F. HILLS, 197 Woodcock Hill, Kenton, Middlesex, as joint technical representatives for the South East Area, for Dean, Smith & Grace, Ltd., Keighley, Yorkshire. These appointments are in accordance with the company's policy of providing for direct representation in certain areas.

Scrap Metals

†LONDON.—‡Prices per ton for non-ferrous scrap metals free from iron are as follows:—clean copper wire, untinned and free from lead and solder, £150; clean heavy copper, untinned and free from lead and solder, £145; second grade copper wire, £140; clean light copper, £135; braziery copper, £122; gunmetal, £125; brass mixed, £91; lead, net, £57; zinc, £28; cast aluminium, £82; old rolled aluminium £107; battery lead, £30; unsweated brass radiators, £75; hollow pewter, £495; black pewter, £365

MIDLANDS.—The very difficult trading conditions in the Midlands as well as in the remainder of the country are not improving, and merchants are hard pressed to maintain scrap collections of grades for which markets have closed completely.

The very limited allocations for heavy steel can be supplied from merchants' yards by the first day or two of each week, and the purchase of oversize scrap for stock is therefore being restricted. Limited tonnages of hydraulically compressed scrap are being consigned to steelworks.

Prices for scrap for use in the blast furnaces have fallen considerably and allocations are still small. The quantities of borings and chipped turnings forthcoming in this area are in excess of demand and merchants have found it necessary to reduce their buying prices in order to make allowance for stocking.

No prices are being offered for light iron and destructor scrap, as such material cannot be moved at all. Many loads of bushy turnings are being put down the "tips" as permit labels cannot be obtained for delivery to works.

At Midland factories it is appreciated that scrap clearance is now more important than the monetary value, and by mutual agreement with the merchants clearing scrap, managements are prepared to accept reduced prices as the position changes.

The foundry trade is quiet, and there is an abundance of short steel scrap everywhere, with stocks increasing daily. The same remarks apply to cast iron scrap.

Current maximum control prices, delivered consumers' works, are now: *Heavy steel No. 1, 217s. 6d.; *heavy steel No. 2, 196s.; *heavy steel No. 4, 207s. 6d.; *heavy steel No. 5, 195s. 6d.; light iron No. 8, 149s.; short turnings No. 9 (free from alloy), 167s. 3d.; light steel No. 11, 164s. 3d.; bushy turnings, 117s.; short alloy turnings, 160s. 9d.; short steel No. 2, 233s. 3d.; machinery cast, 233s.

Prices may be increased up to 2s. 6d. per ton according to quantities tendered over a given period.

* For use by Round Oak Steelworks, Brierley Hill, increase by 1s. 6d. per ton.
† George Cohen, Sons & Co., Ltd., 600 Commercial Road, E.14.
‡ Subject to market fluctuations.

BRITISH MACHINE TOOL

Exports of New Machine Tools

Countries	Vertical Boring Machines		Other Boring Machines		Drilling Machines		Grinding, Lapping and Honing Machines		Automatic Lathes		Capstan and Turret Lathes		Other Lathes		Screwing Machines	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Commonwealth																
South Africa	125 (1)	3,468	—	—	1,363 (80)	25,766	250 (66)	9,415	171 (1)	8,052	225 (4)	8,345	878 (45)	26,747	—	—
India	—	—	1,498 (7)	34,138	1,052 (33)	50,076	1,645 (83)	58,908	164 (1)	8,439	1,052 (21)	47,699	401 (9)	12,145	—	—
Pakistan	—	—	—	—	12 (5)	254	41 (2)	1,496	—	—	—	—	—	—	—	—
Australia	—	—	—	—	956 (22)	26,077	498 (20)	18,128	259 (4)	16,433	660 (23)	25,380	1,001 (57)	36,470	23 (2)	1,816
New Zealand	—	—	—	—	40 (8)	1,147	83 (58)	3,413	—	—	—	—	256 (9)	7,754	—	—
Canada	—	—	628 (3)	19,881	812 (30)	18,847	216 (10)	7,988	57 (1)	2,365	400 (4)	13,335	709 (13)	22,952	86 (1)	2,210
Miscellaneous	390 (1)	9,599	—	—	235 (60)	7,278	499 (50)	13,307	—	—	164 (4)	5,991	1,578 (43)	45,220	—	—
Foreign																
Soviet Union	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Sweden	—	—	—	—	177 (9)	4,789	6 (2)	255	345 (3)	18,417	165 (2)	6,386	48 (2)	2,934	18 (1)	1,504
Norway	—	—	—	—	—	—	21 (5)	922	—	—	—	—	1 (1)	62	—	—
Denmark	—	—	—	—	—	—	25 (1)	836	—	—	44 (1)	1,853	48 (16)	1,641	—	—
Western Germany	—	—	—	—	32 (7)	1,223	21 (4)	3,054	—	—	—	—	166 (7)	6,182	1 (1)	128
Netherlands	—	—	341 (2)	7,291	48 (3)	1,601	7 (7)	437	—	—	—	—	889 (25)	13,721	—	—
Belgium	—	—	—	—	108 (10)	2,347	47 (3)	2,086	—	—	135 (2)	4,178	72 (14)	1,822	—	—
France	—	—	165 (2)	7,804	379 (6)	26,176	524 (14)	27,817	527 (4)	25,818	778 (9)	29,811	101 (23)	4,231	62 (2)	2,258
Switzerland	—	—	—	—	234 (7)	6,232	213 (5)	7,855	—	—	265 (6)	15,951	43 (3)	1,228	—	—
Spain	—	—	344 (1)	12,980	431 (4)	14,464	24 (3)	2,451	825 (6)	42,216	—	—	—	—	—	—
Italy	—	—	36 (1)	3,015	80 (2)	2,373	43 (2)	2,305	156 (2)	11,821	—	—	22 (13)	773	—	—
U.S. America	488 (3)	11,507	—	—	356 (8)	8,266	163 (11)	11,879	37 (1)	997	411 (6)	10,201	338 (20)	11,535	—	—
Miscellaneous	218 (2)	5,826	17 (4)	857	859 (44)	20,634	411 (48)	18,988	456 (8)	33,487	301 (7)	14,700	883 (44)	24,839	60 (2)	3,454
Total	1,221 (7)	30,400	3,029 (20)	85,966	7,174 (338)	217,550	4,737 (394)	191,540	2,997 (31)	168,045	4,600 (89)	183,830	7,434 (344)	220,256	250 (9)	11,370
Amendments to previous accounts																
Commonwealth	—	—	—	—	−4 (−)	—	—	—	—	—	—	—	+1112 (+1)	+23179	—	—
Foreign	—	—	—	—	—	−1,903	−19 (−10)	−31	—	—	−38 (−)	—	—	—	—	—

Total exports of reconditioned machine tools:—Quantity: No., 305; weight, 13,659 cwt.; value £64,445.
Total exports of imported machine tools:—Quantity: No., 15; weight, 2,593 cwt.; value £54,851.

Imports of New Machine Tools

Country of Origin	Boring Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Automatic Lathes	
	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £
Western Germany	259 (4)	18,200	725 (7)	25,698	109 (2)	9,666	3,886 (65)	131,951	3,456 (43)	137,762
Belgium	—	—	—	—	—	—	567 (1)	20,951	—	—
France	1,043 (2)	27,739	—	—	—	—	13 (3)	896	298 (6)	16,888
Switzerland	823 (7)	66,736	21 (4)	1,844	40 (3)	4,946	453 (15)	40,310	967 (34)	70,583
U.S. America	—	—	—	—	214 (1)	12,884	961 (13)	61,734	164 (5)	13,960
Miscellaneous	264 (3)	7,509	31 (7)	867	—	—	730 (13)	31,628	1,196 (9)	35,437
Total	2,389 (16)	120,184	777 (18)	28,409	363 (6)	27,496	6,610 (110)	287,470	6,081 (97)	274, 630
Amendments to previous accounts										
Western Germany	—	—	—	—	—	—	—	—	—	−30
Switzerland	+106 (+2)	+9,872	—	—	—	—	—	—	—	—
U.S. America	—	—	—	—	—	—	—	—	—	—

Total imports of reconditioned machine tools:—Quantity: No., 27; weight, 1,031 cwt.; value, £27,204.

IMPORTS AND EXPORTS (Classified)

and Parts during March, 1958

Threading Machines		Milling Machines		Gear-cutting Machines		Planing, Shaping and Slotting Machines		Presses		Sheet Metal-working Machines		Sawing Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
26 (2)	698	628 (8)	27,241	—	—	467 (5)	13,741	385 (8)	7,141	6 (2)	394	240 (17)	4,987	712 (25)	15,363	420	14,202	5,896 (264)	165,560
—	—	486 (6)	19,827	—	—	128 (2)	2,554	730 (8)	17,999	77 (3)	1,206	36 (2)	1,529	2,154 (48)	77,995	2,008	46,254	11,431 (223)	378,769
—	—	—	—	—	—	20 (1)	200	7 (2)	246	20 (6)	265	—	—	—	—	3	184	103 (16)	2,645
2 (1)	329	795 (13)	28,321	—	—	110 (6)	1,844	584 (3)	9,481	15 (2)	784	41 (3)	804	453 (8)	27,830	136	15,770	5,533 (164)	209,467
16 (1)	471	17 (1)	727	—	—	33 (2)	820	499 (5)	13,004	—	—	—	—	81 (3)	1,812	44	2,526	1,069 (87)	31,674
—	—	471 (12)	16,908	43 (6)	3,953	296 (9)	6,214	1,009 (6)	23,456	210 (1)	5,890	28 (2)	497	51 (2)	991	2,783	68,835	7,799 (100)	214,322
—	—	301 (6)	14,884	—	—	164 (6)	3,699	127 (20)	2,041	266 (4)	3,214	60 (11)	1,696	477 (27)	13,691	158	11,413	4,419 (232)	132,033
—	—	—	—	132 (2)	7,444	—	—	—	—	—	—	—	—	18 (3)	1,820	—	—	150 (5)	9,264
—	—	—	—	—	—	—	—	—	—	3 (1)	241	—	—	72 (3)	4,441	270	6,701	1,104 (23)	45,668
—	—	—	—	—	—	—	—	—	—	—	—	—	—	3 (1)	590	6	399	31 (7)	1,973
—	—	—	—	—	—	64 (4)	1,331	1 (1)	17	—	—	—	—	—	—	76	4,145	258 (23)	9,823
—	—	—	—	—	—	100 (1)	3,419	—	—	—	—	—	—	71 (1)	3,264	52	4,578	451 (21)	21,848
—	—	—	—	—	—	—	—	68 (2)	5,354	—	—	—	—	243 (12)	11,390	41	3,612	1,637 (51)	43,406
—	—	—	—	340 (1)	15,791	209 (1)	6,881	443 (4)	8,944	—	—	—	—	1,887 (22)	78,937	51	3,126	3,292 (57)	124,112
433 (4)	43,696	5 (2)	582	30 (2)	1,932	199 (1)	6,959	140 (5)	4,776	—	—	—	—	—	—	93	11,766	3,436 (74)	193,626
3 (1)	485	—	—	—	—	71 (1)	2,342	151 (3)	6,318	—	—	—	—	20 (1)	177	93	6,154	1,093 (27)	46,742
—	—	913 (4)	36,509	—	—	625 (1)	14,285	57 (1)	5,788	—	—	—	—	—	—	5	1,098	3,224 (20)	129,791
—	—	—	—	—	—	—	—	730 (3)	19,401	—	—	—	—	—	—	39	3,503	1,106 (23)	43,191
—	—	347 (1)	11,320	—	—	118 (1)	3,310	455 (1)	9,600	—	—	—	—	411 (34)	19,602	236	24,219	3,360 (86)	122,436
—	—	270 (7)	13,796	—	—	531 (28)	12,257	687 (21)	9,868	659 (12)	11,264	103 (7)	2,566	471 (46)	23,364	1,013	33,540	6,939 (280)	229,440
480 (9)	45,679	4,233 (60)	170,115	545 (11)	29,120	3,135 (69)	79,856	6,073 (93)	143,434	1,256 (31)	23,258	508 (42)	12,079	7,132 (236)	281,267	7,527	262,025	62,331 (1,783)	2,155,790
—	—	—	—	+165 (+2)	+7,448	−24 (−1)	−116	+475 (+1)	+9,675	—	—	—	—	−48 (−6)	−598	−2	−73	—	—
−29 (−1)	−1,123	—	—	+170 (+1)	+11165	—	—	—	—	—	—	—	—	−337 (−)	−4,006	−457	−7,078	—	—

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts.

and Parts during March, 1958

Other Lathes		Milling Machines		Planing, Shaping and Slotting Machines		Presses and Sheet Metal-working Machines		Other Machines		Machine Tool Parts*		Total	
Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt. and No.	Value £	Quantity. Cwt.	Value £	Quantity. Cwt. and No.	Value £
637 (34)	20,421	1,232 (25)	74,146	64 (1)	3,299	1,241 (25)	38,148	2,648 (148)	91,270	962	67,822	15,219 (354)	618,383
30 (2)	707	—	—	—	—	746 (7)	11,278	397 (5)	13,110	32	2,396	1,772 (15)	48,442
—	—	542 (20)	27,941	—	—	697 (1)	26,958	—	—	103	11,143	2,696 (32)	111,565
18 (2)	2,077	253 (14)	24,272	—	—	21 (2)	1,658	574 (19)	35,566	1,169	64,031	4,339 (100)	312,023
2 (1)	67	412 (3)	29,756	18 (1)	2,986	—	—	1,478 (7)	133,030	1,452	144,033	4,701 (31)	398,450
— (1)	14	1,024 (31)	37,516	38 (1)	1,390	350 (20)	14,481	3,630 (24)	130,129	726	30,050	7,989 (109)	289,021
687 (40)	23,286	3,463 (93)	193,631	120 (3)	7,675	3,055 (55)	92,523	8,727 (203)	403,105	4,444	319,475	36,716(641)	1,777,884
—	—	—	—	—	—	—	—	—	—	+19	−208	—	—
—	—	—	—	—	—	—	—	−106(−2)	−9,872	—	—	—	—
—	—	—	—	—	—	—	—	−83 (−2)	−10,439	—	—	—	—

Figures in parentheses denote number of machines. * Not including machine-tool cutting parts

Gearing Conference

An International Conference on Gearing, arranged by the Institution of Mechanical Engineers, 1 Birdcage Walk, London, S.W.1, will be held from September 23 to 25 in the Institution building. There will be three sessions on the first day, concerned with gear tooth loading; tooth forms, stresses, and failures; and lubrication. During the next day, the production aspects of gearing will be discussed, and the concluding sessions will be devoted to applications in industry.

Some 36 papers will be presented, among which the following may be noted: Excitation of Resonant Vibration by Tooth Meshing Effects; Some Design Considerations Affecting Performance and Reliability of High-duty Gearing for Aircraft; Trends in Gear Cutting and Finishing Processes; Faster Hobbing of Gears with More Accuracy; Developments in Gear Grinding Machines; Quality Control of Automobile Gearbox Gears; A Review of the Application of Gear Drives to Instruments and Power Mounting; Industrial Gear Drives; Development of the Reduction Gear for a Large Propeller Turbine Aero-Engine; Transmission Gears for Highway Vehicles, and Horological Movement Traino-Modern Methods of Analysis and Precise Adjustment.

On September 22 and 26 parties of delegates will visit firms and organizations concerned with gear design and production.

Machine Tool Share Market

Stock markets were very quiet during the period under review, but after being dull and uncertain for the most part, developed a rallying tendency and finished on a steady note, with modest improvements in most sections.

British funds and similar gilt-edged stocks were higher on balance.

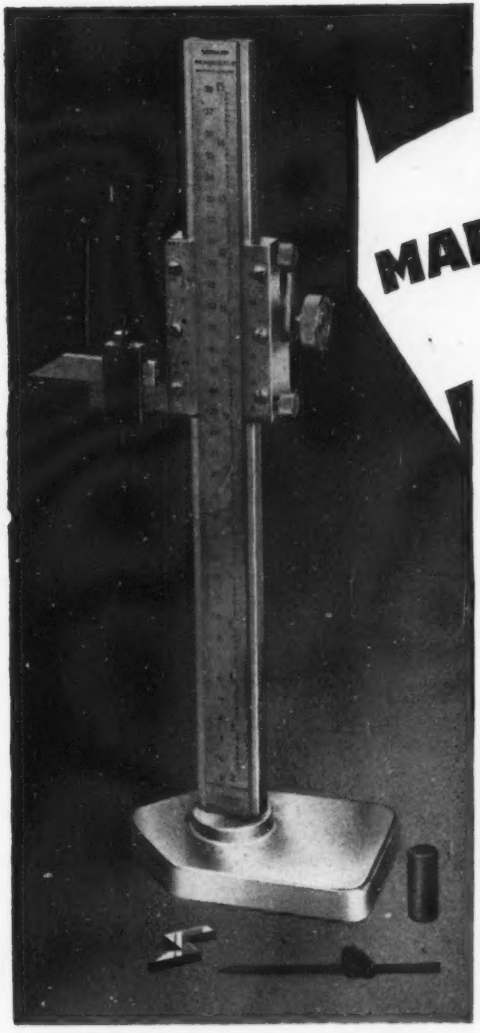
The commercial and industrial sections were mainly subdued, and share prices generally drifted to lower levels, but some resistance was shown to the downward movement, and final prices were above the lowest.

Among machine tool issues, Edgar Allen advanced 1s. to 31s.; Chas. Churchill, 3d. to 4s. 10½d.; Clarkson Engineering, 3d. to 12s. 6d.; Modern Engineering, 3d. to 9s.; Geo. Cohen, 1½d. to 12s.; John Harper, 1½d. to 13s. 4½d.; B. & S. Massey, 1½d. to 8s. 3d.; Coventry Gauge & Tool, 6d. to 14s. 3d.; Stedall & Co., 6d. to 6s. 3d.; and F. Pratt, 7½d. to 21s. 3d. On the other hand, British Oxygen lost 6d. at 34s. 6d.; Churchill Machine Tool, 6d. at 17s. 3d.; and John Shaw & Son (Wolverhampton), 3d. at 12s. 4½d.

B. & S. Massey, Ltd.—Final dividend 7½ per cent., making, with the interim, a total distribution of 12½ per cent (same).

COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	9d.
Armstrong, Stevens & Son, Ltd.	Ord.	5/-	8/3xd
Allen (Edgar) & Co., Ltd.	Ord.	£1	31/-
" " "	5% Prf.	£1	14/9*
Arnott & Harrison, Ltd.	Ord.	4/-	13/6
Asquith Machine Tools Corp., Ltd.	Ord.	5/-	18/9
" " "	6% Cum. Prf.	£1	18/6
Birmingham Small Arms Co., Ltd.	Ord.	£1	28/-
" " "	5% Cum. "A" Prf.	£1	15/6
" " "	6% Cum " B " Prf.	£1	17/6
" " "	4% 1st Mort. Deb.	Stk.	86/-
British Oxygen Co., Ltd.	Ord.	£1	34/6
" " "	6½% Cum. Prf.	£1	21/3
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	4/7½
Broom & Wade, Ltd.	Ord.	5/-	10/4½
" " "	6% Cum. Prf.	£1	17/9
Brown (David) Corporation Ltd.	5½% Cum. Prf.	£1	14/-
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	17/9
Butler Machine Tool Co., Ltd.	Ord.	5/-	5/6
" " "	5% Cum. Prf.	£1	13/9
C.V.A. Jigs, Moulds & Tools, Ltd.	5½% Red. Cum. Prf.	£1	13/9
Churchill (Charles) & Co., Ltd.	Ord.	2/-	4/10½
" " "	6% Cum. Prf.	£1	26/3
Churchill Machine Tool Co., Ltd.	Ord.	5/-	17/3
" " "	6% Cum. Prf.	£1	18/6
Clarkson (Engrs.), Ltd.	Ord.	5/-	12/6
Cohen (George), Son & Co., Ltd.	Ord.	5/-	12/-
" " "	4½% Cum. Prf.	£1	14/6
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	14/3
" " " "	5% Cum. Red. Prf.	£1	16/3
Coventry Machine Tool Works, Ltd.	Ord.	4/-	8/6
Craven Bros. (Manchester), Ltd.	Ord.	5/-	6/7½
Elliott (B.) & Co., Ltd.	Ord.	1/-	2/9
" "	4½% Red. Cum. Prf.	£1	13/9
Export Tool & Case Hardening Co., Ltd.	Ord.	2/-	1/3
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	12/-
Greenwood & Batley, Ltd.	Ord.	£1	48/1½
Harper (John) & Co., Ltd.	Ord.	5/-	13/4½
"	4½% Red. Cum Prf.	£1	13/1½
Herbert (Alfred), Ltd.	Ord.	£1	33/9
Holroyd (John) & Co., Ltd.	"A" Ord.	5/-	10/3
"	" B " Ord.	5/-	9/9
Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	21/3
" " "	7% Cum. Prf.	5/-	5/-
Kayser, Ellison & Co., Ltd.	Ord.	£1	44/6
" " "	6% Cum. Prf.	£1	18/-xd
Kendall & Gent, Ltd.	Ord.	5/-	7/7½
Kerry's (Gt. Britain), Ltd.	Ord.	5/-	6/3
Kitchen & Wade, Ltd.	Ord.	4/-	10/6
Martin Bros. (Machinery), Ltd.	Ord.	2/-	2/4½
Massey, B. & S., Ltd.	Ord.	5/-	8/3xd
Modern Engineering Machine Tools Ltd.	Ord.	5/-	9/-
Newall Engineering Co., Ltd.	Ord.	2/-	4/6xd
Newman Industries, Ltd.	Ord.	2/-	2/3
" " "	6% Prf. Ord.	5/-	5/6
Noble & Lund, Ltd.	Ord.	2/-	2/9
Osborn (Samuel) & Co., Ltd.	Ord.	5/-	17/6
" " "	5½% Cum. Prf.	£1	26/-
Pratt (F.) & Co., Ltd.	Ord.	5/-	21/3
Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	5/-xd
Shardlow (Ambrose) & Co., Ltd.	Ord.	£1	38/-
Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	12/4½
Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	33/9
" " "	5% Cum. Prf.	£1	15/-
Stedall & Co., Ltd.	Ord.	5/-	6/3
Tap & Die Corporation, Ltd.	Ord.	5/-	7/6
" " "	4½% Deb. 1961-1977	Stk.	82/-
Wadkin, Ltd.	Ord.	10/-	18/6
Ward (Thos. W.), Ltd.	Ord.	£1	76/6
" "	5% Cum. 1st Prf.	£1	15/9
" "	5% Cum. 2nd Prf.	£1	24/6
Willson Lathes, Ltd.	Ord.	1/-	2/4½xd

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. * Sheffield price. † Birmingham price.



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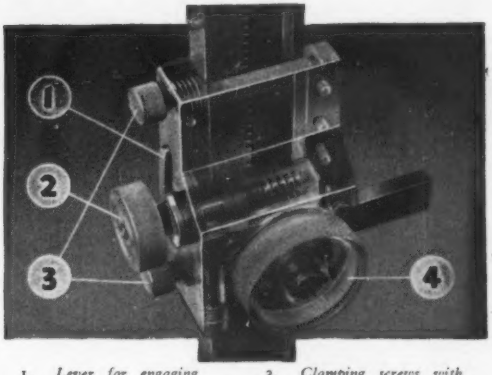

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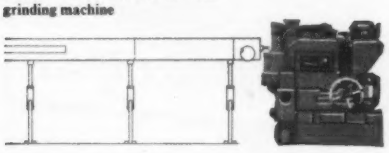
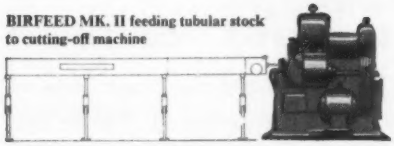
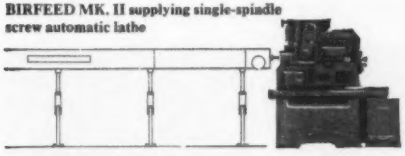
BIRFEED attached to centreless grinding machine



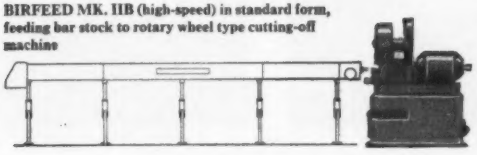
BIRFEED MK. II feeding tubular stock to cutting-off machine



BIRFEED MK. II supplying single-spindle screw automatic lathe



BIRFEED MK. IIB (high-speed) in standard form, feeding bar stock to rotary wheel type cutting-off machine



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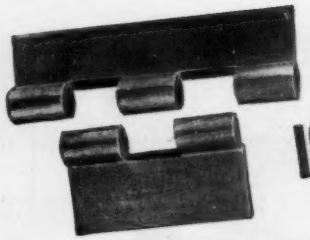

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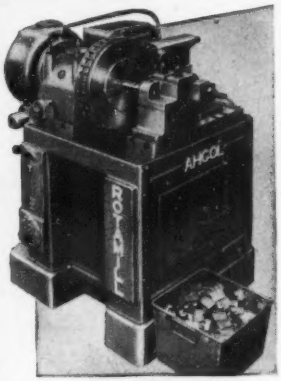

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Cutter width ganged:	6"	4"	8"
Motor:	5 h.p.	1 h.p.	6½ h.p. (two)

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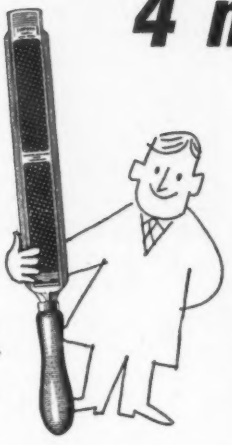

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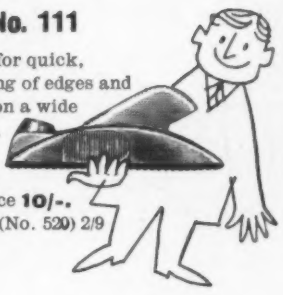

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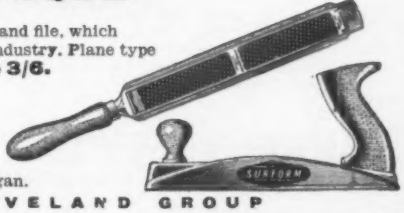

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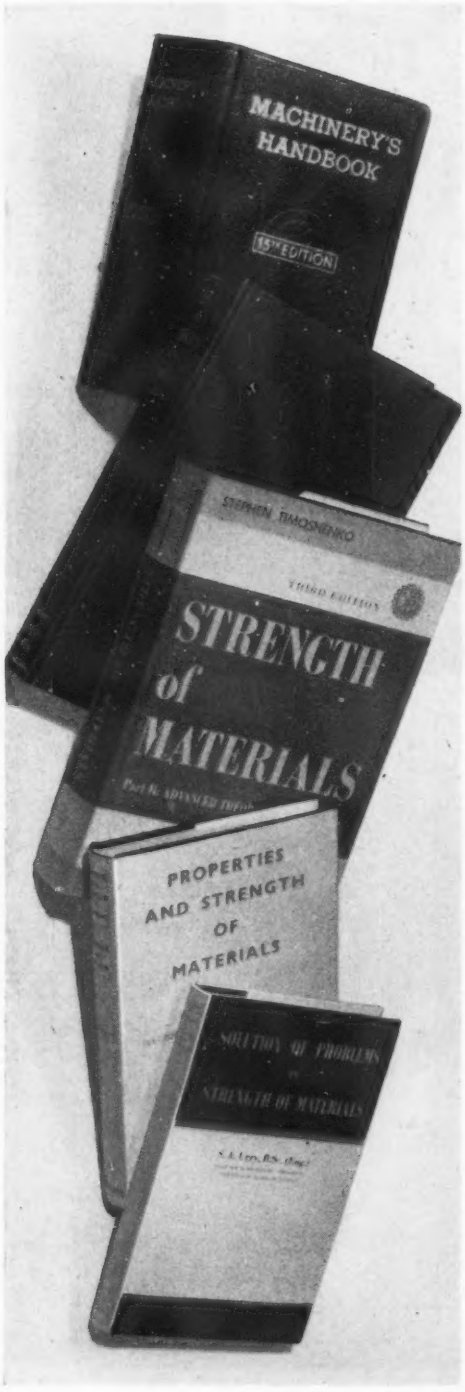

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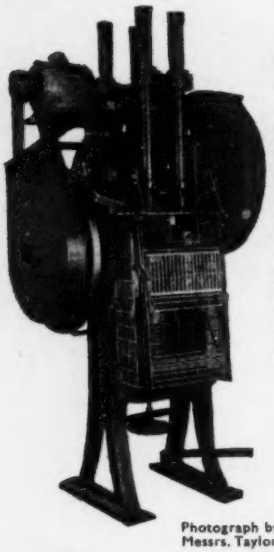

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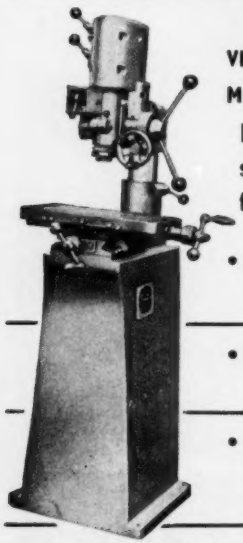

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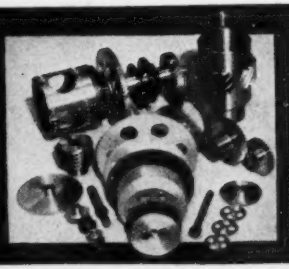

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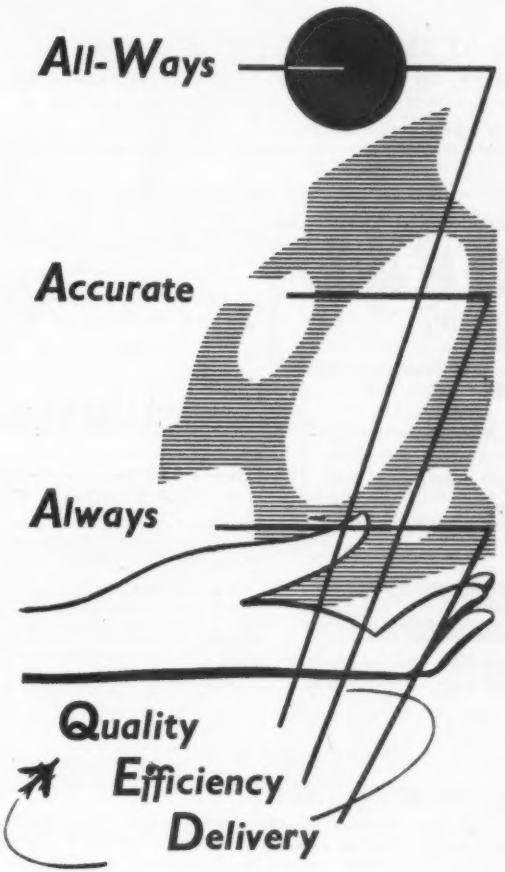

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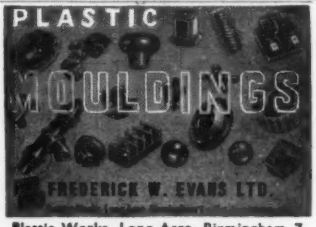

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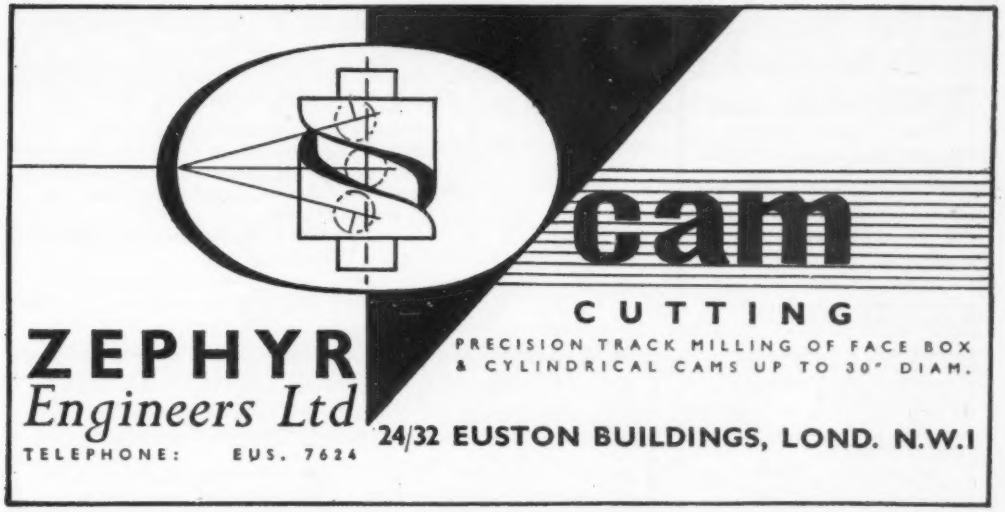

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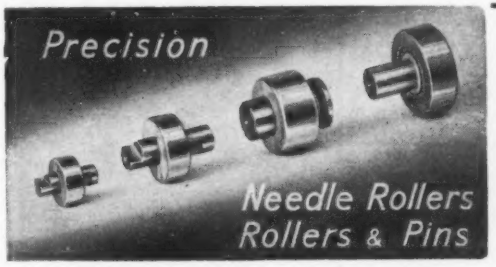

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Capstan Capacity Immediately available 10 B.A. to 1¼in. B.M.S. Stainless, Brass, etc. All materials in stock.—CHISWICK ENG., LTD., Pluckington Place, Southall, Middlesex. Tel.: Southall 2247.

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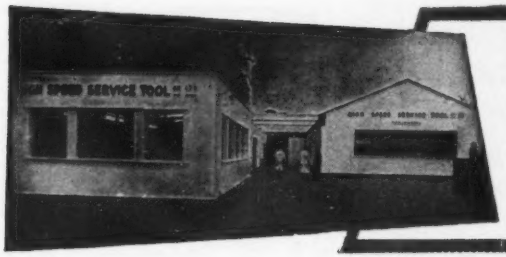

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A complete Gauge, Tool Room and Inspection Department at your service including over 50 grinding machines. Send us your enquiries for Centreless, Internal, External, Blanchard, Surface, Jig, Optical Form Grinding as well as for your Gauge and Tool Work.

Kellering and Cam Profiling capacity up to 8ft. by 6ft., or 6ft. diameter.
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ANNOUNCEMENTS

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See also Page 184 for adverts received too late for classification.

Classified Advertisements (*ANNOUNCEMENTS, contd.*)

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Steel, Aluminium, Brass, Sheets, and Offcuts 10 to 24g. Small or large quantities. Cash payments.—DYAS & FOWLE, 41, Loudoun Rd., N.W.8. MAIda Vale 2711, 5477

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Kings Patent Agency, Ltd. T. R. KING, A.M.I.Mech.E., Registered Patent Agent, 146a, Queen Victoria Street, London, E.C.4. Clay 6161. Booklet on Request.

The Proprietors of British Patent No. 726997 for "Improved Tool, Such as a Milling Cutter or Broach, with Inserted Blades," desire to enter into negotiations with a firm or firms for the sale of the patent, or for the grant of licences thereunder.—Further particulars may be obtained from MARKS & CLERK, 57 and 58, Lincoln's Inn Fields, London, W.C.2.

The Trade Marks Set Out below were assigned by RACHEL SEXTON, of 1, Hatherley Hall, Hatherley Road, Cheltenham, on the 14th February, 1958, to the Bottling Trades Chemical Company, Limited, of Mead Road, Maida Vale, Cheltenham, Gloucestershire, WITHOUT THE GOODWILL OF THE BUSINESS IN WHICH THEY WERE THEN IN USE.

Registration Number	Mark.	Goods.
652189	HYGENTEX	Ice Cream wafer making machinery, milk churns (machines) emulsifying machines and bottle filling machines.
653401	PH-ENTEX	Bottle-washing and filling machines, wringing machines, washing machines, milk separators, emulsifying machines, mixing machines for ice cream, milk plungers (part of machines) and milk churns (machines).

The Proprietor of British Patent No. 787483 and U.S.A. Patent No. 2,821,817, for "Improvements in or Relating to Grinding Machines," would accept commercial exploitation by licence or otherwise.

Manufacturers who are interested are invited to Write "W.Z.," 8, Golborne Road, London, W.10.

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Sheffield Engineering Firm with comprehensive engineering plant and extensive experience in the design and production of all types of machinery, including special purpose plant, wishes to undertake the manufacture of complete or part assemblies, including assembly line production. Own Drawing Office and Pattern Shop. Technical Representatives in all areas.—BOX L771, MACHINERY, Clifton House, Euston Road, N.W.1.

Plastic Moulder, With Toolroom facilities desires co-operation with active distributing or Wholesale organisation with a view to manufacturing articles for their sole distribution.—Write BOX Z36, MACHINERY Clifton House, Euston Road, N.W.1.

Fully Experienced Small Turned parts specialist desires to contact person willing to finance start of small auto. screw machine business. Details at interview.—BOX Z73, MACHINERY, Clifton House, Euston Road, N.W.1.

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SOAG

We invite particulars of your surplus Machines
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Phone: RELiance 7201
Grams: 'Sotoolsag,' London

Wanted, Planing Machine in reasonable condition, open sided though double sided may be considered. Size approximately 2ft. 6in. square by 8ft. to 10ft. stroke.—Details and price to BOX Z82, MACHINERY, Clifton House, Euston Road, N.W.1.

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Machine Tools, Power Presses and Sheet Metal Machinery. Single machines or complete plants purchased. Immediate inspection.—ALBERT EDWARDS (MACHINERY), LTD., 79/89, Pentonville Road, London, N.1.

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OFFER YOUR MACHINES TO
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GOOD CLASS MACHINE tools and sheet metal machinery.
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MODERN MACHINE TOOLS
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Classified Advertisements (*PLANT WANTED, contd.*)

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Late Type Machine Tools
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Telegrams: Emwarneer, Kil., London
One minute from Kilburn Park Station Bakerloo Railway
2 us.

CENTAUR TOOL WORKS, Birmingham, 18, pay best prices for good modern secondhand Machine Tools by first-class makers. Write or 'phone and our representative will call. 'Phone: EDGBASTON 1118 and 1119. 'Grams: Capstan, Birmingham.

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Ask our representative to call and inspect.
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Telephone: GLAdstone 0033

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USED MACHINE TOOLS
We offer generous prices for your plant or accept in part exchange for modern equipment

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Telephone: EDGware 4488/9
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ALL TYPES OF MODERN MACHINE TOOLS
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Tel.: Bilston 42471/4

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We pay cash for single machines or complete plants
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IMMEDIATE INSPECTION ARRANGED
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CONNAUGHT BUILDINGS
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Telephone: Southampton 73101/2/3

Machine Tools and Sheet Metal Working Machinery, modern items of all types required.—CHARLES E. MATTHEWS (MACHINE TOOLS), LTD., 34, Gladstone Road, Croydon. (Thornton Heath 1785.)

Harry Kirk Will Purchase modern quality machine tools for cash. Whole plants or individual items.—Full details to:—
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Machine Tool Division,
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Telephone: Walsgrave-on-Sowe 2313/4.

Modern Good Class Machine Tools and sheet metal machinery required for prompt cash.—H. BELL (MACHINE TOOLS) LTD., WALTER STREET, LEEDS, 4 Tel: 63-7398.

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See also Page 184 for adverts received too late for classification

PLANT FOR SALE

When answering advertisements kindly mention MACHINERY.

Classified Advertisements (*PLANT FOR/ALE, contd.*)

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6ft. × ¼in. Bending Rolls (New).
KITCHEN & WADE 4ft. 6in. Radial Drill, twin motors.
ASQUITH 3ft. 6in. ODI Radial Drill.

W. FORREST & CO. LTD.
INDUSTRY WORKS,
SYLVESTER GARDENS,
SHEFFIELD, 1.
'Phone 23314/5.

Victoria (New) U2 Universal and and V2 Vertical Milling Machines, motorised 400/3/50.—SOUTHERN ENGINEERING & MACHINERY CO., Connaught Buildings, Tanners Brook, Millbrook, Southampton. Tel.: Southampton 73101.

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As our stock changes very rapidly it is not possible to list weekly the machines actually available.

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Over 250 new Machine Tools in stock.

CINCINNATI No. 3 Dial Type Vertical Milling Machine. Speed range 18-450 r.p.m.
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CHURCHILL 16in. by 50in. Universal Grinding Machine. Comprehensive equipment. Unused.
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JONES & SHIPMAN 10in. by 27in. Plain Grinding Machine
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NORTON 6in. by 18in. Surface Grinder.
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SCRIVENER 2C Centreless Grinder.
HENDRY 24in. by 168in. S.S. & S.C. Lathe. Speed range 14-560 r.p.m.
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OLDFIELD & SCHOFIELD 12½in. by 7ft. S.S. & S.C. Gap Bed Lathe. Speed range 12-400 r.p.m.
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ASQUITH Type E.G.C. 8ft. Girder Type Radial Drill. Speed range 31-830 r.p.m.
HEALD 47B Borematic.
KEARNS Type OA Horizontal Boring Machine.
B.S.A. ¼in. Automatic Screwing Machine.
KENCO 6-3 Screwing Machine. Comprehensive equipment.
CLIFTON & BAIRD Punching and Cropping Machine. Capacity 4¼in. by 4¼in. by ¼in. angle.
BIGWOOD 4-Roll Bending and Straightening Machine. Capacity 4ft. by ¼in.

Modern Machines—Motorised 400-440/3/50. Fully Overhauled—Six Months Guarantee.

WESTERN MACHINE TOOLS (SWANSEA) LTD.
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Tel.: 50061/2.

Scriven 3-Roll Plate Bending Machine, rollers 14ft wide, ¼in. capacity.

Archdale 4ft. Radial Drilling Machine, tapping reverse speeds, motorised.

Herbert Filing and Sawing Machine, 15in. square adjustable table.

Alexander 16in. Cutting-off Machine, 12½h.p., 400/3/50.

Herbert Hacksaw, 13in. blade, belt driven.

Wicksteed Hydrofeed Hacksaw, 16in. blade, 6in. by 6in.

Rex Hydraulic Hacksaw, 18in. blade, 8in. by 8in.

Colchester 7in. Centre Lathe, 7ft. gap bed, A.G.H.

Herbert Horizontal Milling Machine, 3ND table 61in. by 15in., 4 spindle speeds.

3,000 K.G. Capacity Avery Hardness Testing Machines, 10in. dia. table (2).

V. & O. 50-ton Inclinable Geared Open Fronted Press; 20-ton Bliss.

Crow Harvey Punch, Shears and Angle Cropper, 18in. blade, 27in. throat, heavy duty.

Pels Punch, Shears and Cropper, 12in. blade, shear 1in., takes 6in. by 6in. by ½in. angles.

Craig & Donald Billet Shears, 8in. blade 6in. by 1in. capacity

Robertson Shears, ½in. capacity, 10 h.p., 28in. blade, 9in. maximum opening. (2)

Robertson 7-roller Plate Flattener, 8ft. 6in. wide, approximately ½in. capacity.

Berry 3-roller Plate Bender, 7ft. wide approximately ½in. capacity.

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Massey 3-cwt. Bottle Forging Hammer also 3/5 cwt. secondhand.

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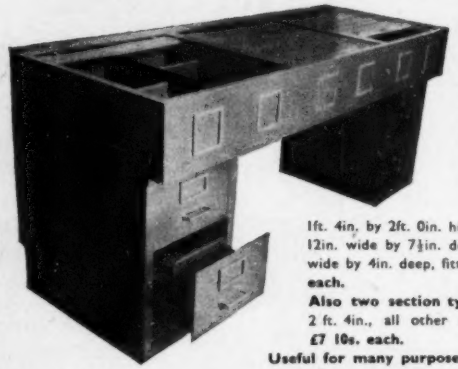

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No. 2M CINCINNATI Vertical Miller.
No. 1 KEARNS Horizontal Borer. Facing, head and spindle.
No. 7 WARD Bar Feed Capstan. Covered bed.
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NEWALL Model 24/42 Jig Borer, built 1955.

KEARNS Model 2 and Model OB Horizontal Borers, traversing spindles, facing heads, wartime built.

RICHARDS 48in. Double Upright Vertical Boring and Turning Mill, two swivelling toolboxes on cross slide, built 1938.

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HERBERT 4BS Bar Capstan Lathe, fitted turret toolholders, pump, bar feed, speeds 30 to 511 r.p.m.

WARD No. 7 Bar Capstan Lathe, bar feed, speeds 20 to 416 r.p.m.

HERBERT No. 20 Combination Turret Lathe, 7½in. diameter spindle, 28in. swing over bed, 97in. distance spindle to turret, Speeds 5 to 201 r.p.m.

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SWIFT 27in. by 17ft. S.S. & S.C. Lathe, swing over saddle 3ft. 4in., swing in gap 6ft. 8in., speeds 2 to 130 r.p.m. Separate feed motor to saddle. Well equipped. Wartime built.

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WILLSON Mark V 7½in. by 48in., S.S. & S.C. Gap Bed Lathe, admits 48in., speeds 54 to 954 r.p.m. and 37 to 739 r.p.m. NEW.

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WARD 2A Capstan Lathe, with collet chuck and bar feed, 1¼in. capacity.

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PLAIN GRINDING MACHINE

CHURCHILL 10in. by 36in. Hydraulic Plain Cylindrical Grinding Machine.

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HERBERT 23V Vertical Milling Machine, 68in. by 17in. table.
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EDGWICK 18in. Production Milling Machine, working surface of table 26in. by 12in.
New **VICTORIA** U1, U2 and U3 Universal Milling Machines.
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CINCINNATI Model 2 M.H. Plain Milling Machine. Tee slotted table 44in. by 7in. With longitudinal power feeds. 15 spindle speeds 23-1,200 r.p.m. Motor Drive 400/3/50.
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ARCHDALE 20in. Plain Horizontal Milling Machine. Table 40in. by 12in. 12 speeds by dial selection 60-1,230 r.p.m. Motor Drive 400/3/50.
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CHURCHILL Universal Grinding Machine, 10in. by 24in. between centres.
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COLCHESTER 'Triumph' 7½in. × 48in. Lathe. Coolant, fourway toolpost, etc.
MITCHELL 8½in. Gap Bed Lathe, 4ft. 3in. between centres, fourway toolpost, chucks, etc.
VICTORIA U3 Universal Miller, 60in. × 12½in. table, rapid traverse.
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SMART AND BROWN Model 'A' 4¼in. S.S. & S.C. Precision Toolroom Lathe.
HARRISON 8in. × 48in. Lathe. Fourway toolpost, chucks, steadies, etc.
MODERN 18in. × 6in. Fully Automatic surface Grinder, 12in. wheel to table.

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CHURCHILL No. 1 Planetary Grinder.
ORCUTT HM24 Gear Grinder, 1944.
CINCINNATI 1/18, 2/24 Prod. Mills.
RYDER WELLMAN Horiz. Borer, 3 insp.
B. & S. OOG S.S. Autos. 1942.
LA POINTE 2SL Horiz. Broach.
VICTORIA U2 Mill, with dividing hds., 1955.
ACME GRIDLEY 2¼in. S.S. Auto, 1942.
MODERN 6in. × 18in. Surface Gdr., 1953.
CHURCHILL OSV 40in. × 10in. Vertical Spindle Surface Grinder, 1942.
ARCHDALE 30in H.D. Pillar Drill, 1942.
GISHOLT 4, 5 and 1L Turret Lathes, 1941-43.
WARNER & SWASEY 3, 5 and 3A Turrets.
HERBERT 2D, 4, 4 Senior Turret Lathes.
B. & S. No. 3 Vert. Mill, 1942.
WARD 2A and 3A Capstans, 1942.
ARCHDALE 18in. and 30in. Vert. Mills, 1942.
CINCINNATI 2MH & No. 2 Plain Mills, 1942.
HEALD 48A S. End Boremat ics, 1941-44.
DEFIANCE No. 5 Hor. Borer, 3in. sp., 1941.
B.S.A. ¾in. S.S. Automatics, 1941.
CINCINNATI 1L and No. 2 Vert. Mills, 1942.
B. & S. No. 2 Universal Grinders, 1941.
NEWALL 10 by 24/48 Grinders, 1942.
MONARCH Magnamatic Prod. Lathe, 1946.
ORCUTT 5in. by 36in. Spline Grinder, 1944.
V.D.F. 10in. by 72in. Centre Lathe, 1941.
CINCINNATI 3/24, 3/36 Hydromatics, 1945.
HERBERT 0, 1 and 33 Plain Mills, 1940.
P. & W. 12B 2-spindle Profiler, 1941.
KITCHEN & WADE No. 2 Cyl. Hone, 1940.
CHURCHILL NB 6in. × 18in. S. Gr., 1942.
CHURCHILL Centreless Gr., Model EC, 1940.
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Machine Tool Sales Representative required for S.E. England and part of London. Must have good knowledge of area, first-class selling experience and connections. Salary, commission, expenses and car. Pension Scheme. (Own staff advised of vacancy.)—Apply in confidence, giving full details of age, experience, etc., to: Managing Director, BOX Z118, MACHINERY, Clifton House, Euston Road, N.W.1.

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Technical Representative Required in Midlands area for the sale of Tungsten Carbide products of International repute. Applicants should be technically trained men able to demonstrate Carbide Tools. —Please reply in own writing stating age, education, experience and salary required to BOX Z94, MACHINERY, Clifton House, Euston Road, N.W.1.

Representative Required by London Company marketing specialised machine tools. Generous remuneration and good prospects for experienced man with enthusiasm and appropriate connections. Car provided.—BOX Z70, MACHINERY, Clifton House, Euston Road, N.W.1.

SITUATIONS WANTED

Senior Buyer, Keen Energetic, at present with a leading manufacturer of mechanical handling equipment, wide contacts, used to control of staff and modern buying methods, seeks position with responsibility for buying function with progressive company.—Write BOX Z95, MACHINERY, Clifton House, Euston Road, N.W.1.

Auto Setter Wishing to Move to London area seeks employment. Age 36. Experienced Index, B. & S., C.V.A. and Wickman Multi Spindle. Working knowledge layout and Cam Design.—BOX Z108, MACHINERY, Clifton House, Euston Road, N.W.1.

General Manager of Medium size engineering company requires similar position with view to Directorship. Fully qualified Production Engineer with drive and initiative together with integrity and common sense as the main factors. Fully conversant with all departments including planning, tool design, time and motion study, progress and all types of precision machining and costing. Able to control economically from design to finished product of development quantities, small or large batch type production. Locality London area or Southern England. Age 42. Available November, 1958.—BOX Z109, MACHINERY, Clifton House, Euston Road, N.W.1.

Practical Engineer, Aged 47, light engineering, planning, ratefixing, time study experience, could take charge and boost production of small factory.—BOX Z115, MACHINERY, Clifton House, Euston Road, N.W.1.

Practical Engineer, 30 Year experience in the Workshops. Machine and fitting, etc. General, Development, and Toolmaking. Administrative background with practical ability. Seeks position in practical field.—BOX Z56, MACHINERY, Clifton House, Euston Road, N.W.1.

Senior Mechanical Designer. Former Chief Draughtsman. Seeks progressive situation. Experienced in great variety of Machinery, Special Purpose Machines, General Tooling, Machine Tools, Industrial Turbines, Aero-Engines, Heavy Engineering, etc.—BOX Z119, MACHINERY, Clifton House, Euston Road, N.W.1.

REPRESENTATIVES

A Very Well Known and Experienced free lance Sales Representative covering Scotland, seeks an additional agency in Instruments, Mechanical Tools or Machine Tools. Entree to every Engineering firm at all levels. Complete coverage with enthusiasm and integrity.—BOX Z92, MACHINERY, Clifton House, Euston Road, N.W.1.

Technical Representation. Enthusiastic young man, with 10 years' experience in the machine tool trade plus necessary personal qualifications, seeks career as Technical Representative. The advertiser, having completed an apprenticeship, spent a year on the Continent and travelled as a service engineer/demonstrator, is ready to consider any genuine offer.—BOX Z127, MACHINERY, Clifton House, Euston Road, N.W.1.

RECEIVED TOO LATE FOR CLASSIFICATION

PLANT WANTED

URGENTLY REQUIRED

HORIZONTAL UPSET Forging Machine, 4in. or 5in. capacity.
PNEUMATIC HAMMER 2 or 3 cwts.
TAYLOR & CHALLEN No. 6 Double Action Deep Drawing Power Press.
HYDRAULIC Double Action Power Press with approx. 9ft. square bed area, 500/650 tons capacity.
HYDRAULIC Single Action 1,200/1,500 tons capacity, suitable for Planishing.
HYDRAULIC Double Action Press, similar to T. & C. No. 6.

BOX Z116, MACHINERY, Clifton House, Euston Road, N.W.1.

Wanted: Strip Forming Multi-Slide Machine. Heenan & Froude or similar. In any condition.—Apply BOX Z121, MACHINERY, Clifton House, Euston Road, N.W.1.

Wanted, Cincinnati No. 3 Dial Feed Vertical Miller.—BOX Z132, MACHINERY, Clifton House, Euston Road, N.W.1.

B.S.A. SINGLE SPINDLE AUTOMATICS, late Type Machines only, other makes considered.

BOX Z 125, MACHINERY, Clifton House, Euston Road, N.W.1.

Wanted, Landis or Churchill 10in. by 18in., 10in. by 24in. Plain Grinder. Must be in good condition. Please state serial number and price required.—BOX Z130, MACHINERY, Clifton House, Euston Road, N.W.1.

CONTRACT WORK

Centreless Grinding is the Answer to many production problems. We specialise in it, and so perhaps can help you. We have capacity from ⅛in. up to 3in. diameter for all types of centreless grinding and can also make your complete components on our Autos and Capstans. (Up to 1⅛in. diameter.)

We believe our prices are as competitive as any, and we know our deliveries are better than most. 'Phone or write for quotation or ask for our representative to call. We collect and deliver.—FITZNER LIMITED, 197-199, Kings Road, Kingston-on-Thames. Tel.: KINgston 1451.

Immediately Available: Press Capacity on 70-ton Cushioned Turner (TB70) Press. 6in. stroke, maximum Shut Height 12in. — HYDULIGNUM - JABROC (TOOLS), LTD., Bristol Road, Gloucester. Tel.: Gloucester 24941.

PATENTS—TRADE MARKS

The Proprietor of British Patent 778060, "IMPROVEMENTS IN OR RELATING TO RECORD CONTROLLED MACHINES," desires to conduct negotiations for the grant of license.—BOX Z122, MACHINERY, Clifton House, Euston Road, N.W.1.

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Small Manchester Engineering Company desires contact person or firm with ideas and contacts for utilising existing facilities. At present solely subcontract machining (Turning, Milling, Planing) but future obscure. Financial interest not objected to.—BOX Z128, MACHINERY, Clifton House, Euston Road, N.W.1.

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